...ineering
...rary

ELECTRICAL WORLD

JUN 21 1932

JUNE 18, 1932
McGraw-Hill Publishing Company, Inc.
25 cents per copy

VARTEX

VARTEX
TRADE MARK REG. U.S. PAT. OFF.
THE PEAK OF QUALITY

SALES REPRESENTATIVES:

Alexander Beck, Inc.,
110 Jerry St., Hoboken, N. J.

G. J. Gallagher,
131 State St., Boston, Mass.

Insulation Manufacturers Corp.,
902 Leader Bldg., Cleveland, Ohio.

Insulation Manufacturers Corp.,
565 W. Washington Blvd., Chicago

Harry A. Beach Sales Co.,
306 Powers Bldg., Rochester, N. Y.

Close Distributing Company,
129-131 First Ave., Pittsburgh, Pa.

ENGINEERS whose responsibilities are greatest know Vartex best. For more than twenty-five years they have relied upon the uniformly high electrical and mechanical properties of Vartex Varnished Cambric to meet their most rigid insulating requirements for cables, motors, generators and transformers.

Samples, prices and full information gladly supplied on request.

NEW JERSEY WOOD FINISHING CO., Inc.
FOUNDED 1907
ELECTRICAL INSULATION DEPARTMENT
Woodbridge New Jersey

THE PATH OF LEAST RESISTANCE

Murray Hollow Ground Rods provide the easiest and most economical way of lowering and maintaining ground resistances to desired values. The imbedding of treating solution at or near the permanent moisture level means that solution is where it will give immediate results — where it will last the longest and where it will do the most good.

A low resistance ground path for lightning discharge is good business, for it assists your protective devices to do their full duty.

Treating solution poured or pumped into the copper tubing dissipates into the surrounding soil through the holes in the tubing.

Treating the MURRAY way means that precipitation will not affect the path to ground.

Where on your system have you encountered stubborn high resistance? Why not make a test installation there?

Send for booklet— tell us your problems.

MURRAY
HOLLOW GROUND ROD

METROPOLITAN DEVICE CORPORATION, Brooklyn, N. Y.

Gentlemen:—

Send 8 Page Booklet Describing the Murray Hollow Ground Rod.

Name .....

Position .....

Company .....

Address .....

ELECTRICAL WORLD

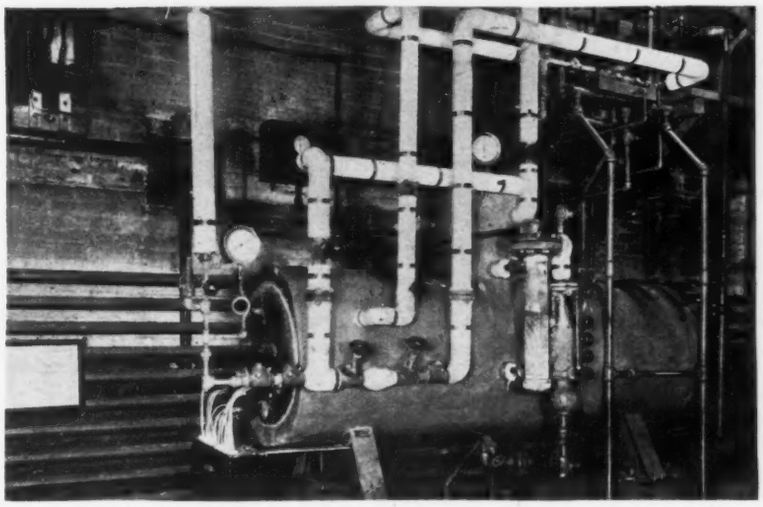
A consolidation of Electrical World, Electrical Engineer and American Electrician

ALLEN M. PERRY
Managing Editor
EARL WHITEHORNE
Contributing Editor
G. F. WITTIG
Statistical Editor
A. E. KNOWLTON
Associate Editor
F. C. WELLS
News Editor
E. R. SEARLES
Assistant Editor

L. W. W. MORROW, *Editor*

FRANK R. INNES
Western Editor
520 N. Michigan Ave.
Chicago
H. S. KNOWLTON
New England Editor
1427 Statler Bldg.
Boston
PAUL WOOTON
Washington
Correspondent
National Press Building
Washington

JAMES H. RUDD
Publishing Director



60/120-kw. electric steam generator, Celluloid Corporation, Newark, N. J.

JUNE 18, 1932

Contents, Copyrighted, 1932, by McGraw-Hill Publishing Company, Inc.

VOLUME 99 . . . NUMBER 25

Utilities and Public Welfare.....1052
BY FLOYD L. CARLISLE, *Chairman Consolidated Gas and Niagara Hudson*

Three New Classes of Locomotives.....1058

May Industry on April Level.....1061

Doherty Tower Floodlighted.....1062
BY ALFRED PAULUS AND A. SIRA, *Westinghouse Lamp Company and Clinton & Russell, Respectively*

Where Continuous Service Is Imperative.....1065
BY A. L. O'BANION

News of the Industry.....1041
Editorials 1050
Exhibitors Encouraged at Atlantic City 1055
4-Ton Induction Furnace Installed in Midwest 1056
Capacitance Transformers for Ground Directional Relays...1057
Rural Service Needs Selling..1057
Electric Welding Saves Steel on Hospital Job 1069
Plant Distribution on a Watt-Per-Square-Foot Basis 1070
Readers' Forum 1070
Men of the Industry.....1071
New Equipment Available...1072

Electrical World articles are indexed in Industrial Arts and Engineering Indexes, available in public libraries

Published weekly. $5 per year. 25 cents per copy. Central and South American countries, $7. Foreign, $9 U. S. currency, or 45 shillings per year. Canada subscription price (including Canadian duty), $7.50. Entered as second-class matter, January 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A. Cable Address: "MCGRAWHILL, N. Y." Member A.B.P. Member A.B.C. Number of copies printed this issue, 15,800.

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

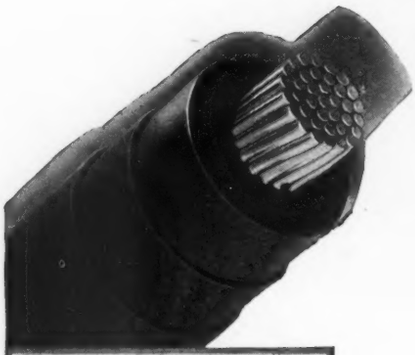
Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Greenville, S. C.; Los Angeles. James H. McGraw, Chairman of the Board; Malcolm Muir, President; James H. McGraw, Jr., Vice-President and Treasurer; Mason Britton, Vice-President; Edgar Kobak, Vice-President; H. C. Parmelee, Vice-President and Editorial Director; Harold W. McGraw, Vice-President; C. H. Thompson, Secretary.

PAPER

Oil-filled
Solid, shielded Type H
Solid, nonshielded, belted

MISCELLANEOUS

Station, apparatus, control cable, and switchboard wire insulated with asbestos and with varnished cambric and asbestos
Nonignitable rheostat leads
Braided copper pigtail leads
Magnet wire and coils

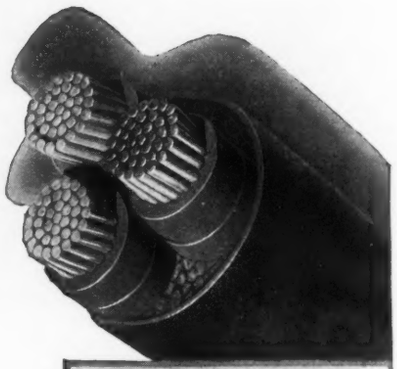


CAMBRIC

Standard braided and leaded
Transformer leads
Apparatus
Switchboard wire

CABLE ACCESSORIES

Unit package joints
Straight or normal joints
Bifurcating, trifurcating, and stop joints
Split and normal-sheath insulators
Pressure, feeder, and conservator reservoirs and fittings
Terminals, potheads, end bells
Spreader castings for terminals
Coupling, tee, fuse, and junction boxes
Splicing tapes and compounds
Portable degasifiers and oil pumps
Adjustable cable racks



RUBBER

Standard braided and leaded
Parkway and rural-service
Mining-machine and gathering-reel
Station and traffic-control
Train and jumper
Portable
Dynamo and brush-holder
Car cables
Motor leads
Arc-welding
Neon-sign
Tree wire
Service-drop
Bracket-lead
Hot-bed
Trolley-bus
Corona-proof

The above cable can be insulated with any one of the following compounds:

Code, intermediate, 30% performance-test, and 30% A.S.T.M.

40, 50, 60% high-quality and 60% tellurium-compounded

(High-insulation-resistance, long-life for railway-signal use)

Corona-resisting

Nonhygroscopic

G-E INSULATED CABLE

Any Size Any Type Any Voltage

For Aërial, Underground, and Submarine Applications

810-12

GENERAL ELECTRIC

ELECTRICAL WORLD

Established 1883. McGraw-Hill Publishing Company, Inc.

for the Week Ending

June 18, 1932

Federal Trade Investigation Speeded by Simultaneous Examinations

SEVERAL hundred pages have been added to the interminable records of the utility investigation—on which the Federal Trade Commission has been working four years and three months—since the ELECTRICAL WORLD printed its last previous summary on May 28. Last week the National Light, Heat & Power Company of Augusta, Me., the Twin State Gas & Electric Company, its operating subsidiary, and the Tide Water Power Company of Wilmington, N. C.—all Middle West Utilities Company units—though the testimony covered periods antecedent to as well as subsequent to Insull control—were up for examination. Examiners Buckingham, Steele and Dickerman produced the usual mass of financial and accounting detail and dwelt, as usual, on inflated book values and arbitrary write-ups of capitalization when new properties were acquired.

Data of this kind covered an appreciation of $1,841,550 on the books of the National Light, Heat & Power affecting common-stock, preferred-stock and bond investments. Of this amount $1,350,000 was caused by Twin State Gas & Electric write-ups. Properties purchased by the company last named were, it was testified, recorded in the company's books at more than 100 per cent over their historical cost. These properties included plants at Dover, N. H., and Brattleboro, Vt. Through one transaction, Mr. Steele asserted, the Middle West Utilities received $650,000 par value of Twin State common stock at no cost and the remaining $600,000 of the same stock went to the National Light, Heat & Power "as a donation from Middle West." "This indicates," the examiner testified, "that the $1,250,000 par common stock was given as a bonus at a value of $1,000,000, which amount was reflected in the ledger cost to the Twin State company of the properties received and thus capitalized." Other similar alleged manipulations were described.

Tide Water Power Company affairs came up on Friday, June 10. Total fixed capital on the books of the company at the close of 1930, said Mr. Dickerman, was $8,924,908 and included appreciations of more than $2,700,000. By the end of 1931 the fixed capital had increased to $11,120,544, due largely to the acquisition of five gas plants and an electric and water system. The examiner testified:

The physical property reflects the facts that in the course of the 25 years and more in which utility service has been supplied in some of the areas now within that served by Tide Water many diverse and usually out-of-state owners have had possession and have generally installed and maintained property piecemeal and as cheaply as possible and have retained old property in existence without any general cleaning out and modernizing. This situation in a way reflects the judgment of the various owners that growth could not be expected to be great, justifying wholly new and modern plants. Yet these not more than moderate-grade properties have been the basis for the construction of fixed-capital accounts and security issues which are far removed from the conservative character of the area served and the business available.

On Tuesday, June 14, the commission began an examination of Associated Gas & Electric properties, to last several days, and on Wednesday a simultaneous investigation of the Utah Power & Light Company began in another room.

At the Tuesday session on Associated the management fees of the system were put under fire by S. Davis Wilson, Philadelphia lawyer, and Benjamin Foster, a stockholder in the Florida Public Service Company, a subsidiary.

Mr. Foster contended that "enormous management fees" impose great hardship on the operating companies.

Mr. Wilson placed in the record a complaint filed by Foster in a Florida court alleging that since 1928, under Associated management, the Florida company's operating expenses increased from 41.7 per cent of its total revenue to 50.4 per cent in 1930, while labor and material costs were declining.

In 1928, Mr. Foster's complaint said, fixed charges amounted to $822,311 "under the management and control of the company's proper officers and directors." By 1931, the complaint added, these charges had increased to $1,084,108 under Associated Gas & Electric management without a corresponding increase of gross revenue.

This Week

N.E.L.A. should enforce an industry code of ethics — Floyd Carlisle. p. 1052

Construction of Boston tunnel fully electrified. p. 1065

Floodlighting of Doherty tower uses light and shadow. p. 1062

Traditions discarded in building Pennsylvania locomotives. p. 1058

Peek doubles voltage values for artificial lightning. p. 1049

Shot-welding for stainless steel is licensed. p. 1047

Moving Sidewalks May Replace Subways

Instead of individual trains making bursts of speed between underground stations two continuous trains or belts of cars on parallel tracks with a stationary landing platform along the entire route would eliminate jams at station stops, simplify operation, reduce noise and handle more people safely in less time than any transit system yet devised, it is claimed. Norman W. Storer, consulting transportation engineer for the Westinghouse Electric & Manufacturing Company, who evolved the idea, states that compared with New York's new Eighth Avenue subway such a system could handle 28 per cent more people an hour, 205,000 passengers instead of 160,000.

Electrically operated, of course, with driving motors stationary between the tracks at intervals of about 1,000 ft., the "Biway" idea is essentially the development of the moving sidewalk principle. It is estimated that a demand of less than 600 kw. per mile of one-direction service in rush hours would be needed. This is said to be about one-seventh of the peak power load required for a single ten-car subway train.

Essential elements consist of the continuous stationary platform, from which the "trains" may be boarded. A local or transfer platform, also continuous, stops to receive passengers every 50 seconds. Between stops it reaches a speed of 17 m.p.h., the speed of a second continuous platform known as the express train, which would reach a maximum speed of 22 m.p.h.

Passengers would board the first of the moving platforms at any point. When it is moving at the speed of the second parallel platform gates open and passengers may enter the express. There is a loading and transfer every 50 seconds. Each of these operations is allowed ten seconds and no one need wait for a train more than 40 seconds.

▼

Stockholm Topics for 1933 World Power Conference

An official announcement of the sectional meeting of the World Power Conference to be held in Scandinavia from June 26 to July 10, 1933, with the technical sessions at Stockholm, has been issued. It includes an outline of the program and a timetable of the visits to be made to Norway, Denmark and Finland and can be procured from O. C. Merrill, chairman of the American Committee, 1419 Chrysler Building, New York. Topics include:

"Energy Supply of Large-Scale Industry."

"Power and Heat Combinations."

"Transmission and Adaptation of Motive Power for Industrial Machinery."

"Energy Problems of Railroads."

"Special Energy Problems in the Iron and Steel Industry."

▼

NEW IDEAS PREVAIL IN PICTURE-THEATER LIGHTING

—Keystone View Co.

In a motion-picture auditorimum designed by B. Schlanger and R. Irrera, New York, new effects in lighting accompany what is called a parabolic floor, which rises toward the screen instead of away from it. Greater comfort in seeing, through the elimination of eye strain, is said to be achieved in installations of this character.

Interstate Power Control Sought by Republicans

Legislation to authorize the regulation of charges for interstate energy sales was incorporated as a plank in the proposed party platform which Chairman James R. Garfield of the resolutions committee read to the Republican national convention on Wednesday of this week. No action altering this plank had been taken up to the time of going to press. The plank reads as follows:

Supervision, regulation and control of interstate public utilities in the interest of the public is an established policy of the Republican party, to the credit of which stands the creation of the Interstate Commerce Commission, with its authority to assure reasonable transportation rates, sound railway finance and adequate service.

As proof of the progress made by the Republican party in government control of public utilities, we cite the reorganization under this administration of the Federal Power Commission, with authority to administer the federal water-power act. We urge legislation to authorize this commission to regulate the charges for electric current when transmitted across state lines.

▼

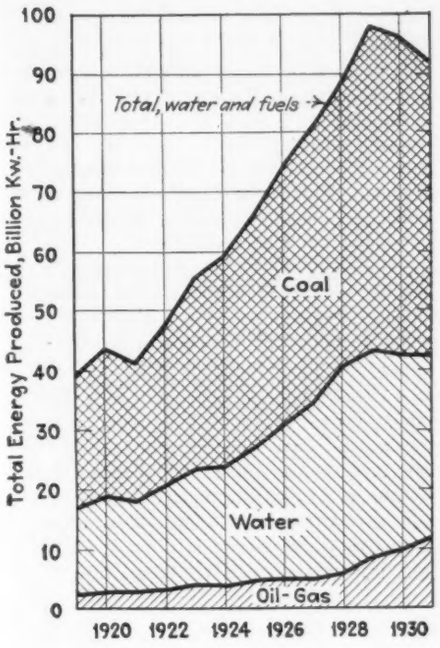
Pole Line Assembled Before Being Erected

Elimination of the relatively hazardous work of pole climbing and of working there on line assembly is accomplished in the recently instituted transmission and distribution practice of an important Southern utility, which provides for complete assembly of poles, crossarms, insulators, conductors, etc., before the poles are stepped and while they lie on the right-of-way horizontally.

Briefly, the features of the plan adopted are these: Poles are delivered to the right-of-way and at right angles to it; poles are then completely framed with all attachments, including guys and special equipment; all conductors are strung at one time, using a wire-stringing tractor with equalizer equipment and dynamometer; the hole digger and pole setter lines up at the stake for co-ordinated action, and the hole is filled with dry sand in bags after the pole is plumbed and partial back-fill has been made.

The method is limited to relatively level, non-rocky terrain where long spans and lengthy hauls for special equipment can be avoided. Complete labor costs of slightly more than $300 a mile (but not including clearance of right-of-way) have been realized in several instances. Other advantages include: Small crews necessary, single entry to right-of-way; specialized work for each crew member, and improved working conditions.

Use of Coal by Power Industry Decreases



Oil and gas are assuming more and more of the energy production burden in American electric light and power practice, according to a recent report of the prime movers committee of N.E.L.A. In 1931 oil and gas accounted for nearly 12 per cent of the total energy produced, coal for about 55 per cent and hydro 33 per cent. It is probable that 1932 figures will show further losses in coal and gains in hydro due to the large water flow in some sections and the full economic use of interconnected systems with hydro resources.

▼

Oregon Hydro Commission Views Hood River District

In a final report on the advisability of creating a Hood River People's Utility District the Oregon Hydro-Electric Commission shows that if bonds to the amount of $914,641, bearing not to exceed 5 per cent interest, can be sold at par, it would be financially feasible for the district to be formed and to enter upon the purchase and distribution or generation and distribution of electrical energy. If organized, the commission holds, the plan should include acquisition of the transmission and distribution system of the Pacific Power & Light Company now serving the territory, following the acquirement of which it would be prudent for the district to purchase from the private utility the necessary energy. This would not involve a heavy bond issue and would give the people an opportunity to perfect an organization and prepare for the installing of a hydro-electric or fuel-burning generating system, or both, if the needs and financial ability of the district should later justify. A posssible rate saving of approximately 10 per cent, amounting to $16,000 per annum, is figured in the commission's report.

▼

Obviating Federal Regulation of Holding Companies

On the ground that "bureaucracy is fastening its deadly tentacles too persistently into our national life," federal regulation of holding companies was opposed at a recent conference in Boston of New England securities commissioners. Robert C. Clark, banking and insurance commissioner of Vermont, turning to the problems of State supervision of securities, pointed out that the most puzzling feature of holding-company affairs is the present maze of intercompany relationships and the determination of the real value of the equity holdings in subsidiaries. "Cannot this be corrected," he queried, "by a closer co-operation between state securities commissioners in exercising control over security sales? If such commissioners would devise a uniform annual statement form and insist upon its use by all companies whose securities are registered, it would simplify matters tremendously. Add to this periodic examination of company books either by examiners from several state departments or by certified public accountants under the direction of a group of commissioners and we would have a real check on the security behind their issues.

"How can we reach any reliable decision from a study of a consolidated balance sheet or consolidated earnings statement?" asked Mr. Clark. "If we have to permanently rely on them, it will be fortunate if we do not have many repetitions of the Ivan Kreuger fiasco." The speaker admitted that the procedure he recommended would be expensive, but held that it is a legitimate expense for the utility business to bear. "The damage today," he said, "is being done in large measure by the unscrupulous organizer who is playing on the reputation and success of managers of sound holding companies to inflame the imaginations of investors into the belief that any company entering the utility field cannot help succeeding. It is these shoestring operators who should be weeded out and the honest, conservative concern should welcome any means for separating the sheep from the goats. If the proposal is sound, it should have the hearty support of every legitimate undertaking. This sort of co-operation has proved very effective in the insurance field."

Withdrawals of Gold May Cease

HAILED by financial observers as a most encouraging development, the last of France's dollar balances was withdrawn from the market on Tuesday. This completes the difficult achievement of repaying all but $700,000,000 of the $3,000,000,000 of short-term funds lodged in this market by foreign interests. Our gold stocks were reduced from $5,015,000,000 in September, 1931, to $3,979,000,000 as of last week, but aside from the shipment of some $454,000,000 now earmarked for foreign account no further large drains are anticipated. The recovery of the dollar in foreign exchange trading was spectacular.

Bonus agitation resulted in passage of the measure by the House with a vote of 209 to 176. The Senate is not expected to vote for it. President Hoover would probably veto such a bill, and while the measure will in all likelihood fail, the menace of it still stands.

Business indicators continue unfavorable. Car loadings slumped badly once more. Energy production shows a little gain. Security markets continue weak in spite of bond pool propaganda. Income tax receipts drop $800,000,000. Corporation earnings continue decline, with several months of probable poor business just ahead.

Protests Are Made Against Sales of Safe Harbor Power

Labor organizations, chambers of commerce, mine operators, newspaper publishers and community officials joined last week in a protest against applications filed with the Pennsylvania Public Service Commission by the Pennsylvania Water & Power Company and the Safe Harbor Water Power Corporation respectively, the former seeking permission to supply electrical energy generated at the Safe Harbor Dam to the Pennsylvania Railroad, while the latter asked leave to begin the general distribution of electricity in certain townships in Lancaster and York Counties.

The objections were based on the ground that the distribution of this hydro-electricity would curtail the production of anthracite and add to unemployment troubles. It was represented that substitution of water-generated power for steam-generated power would mean an annual reduction of about 360,000 tons in the consumption of antracite. Objections also were filed against the application by the Pennsylvania Power & Light Company, which claims that the other companies propose an invasion of its territorial rights. It was contended that Safe Harbor corporation's charter limits it to the sale of power to distributing companies.

Coming Meetings

Public Utilities Advertising Association—Waldorf-Astoria, New York, June 21 and 22. J. R. Pershall, Public Service Co. of Northern Illinois, Chicago.

Association of Iron and Steel Electrical Engineers—William Penn Hotel, Pittsburgh, June 20-23. J. F. Kelly, Empire Bldg., Pittsburgh.

American Society of Agricultural Engineers—Ohio State University, Columbus, Ohio, June 20-24. Raymond Olney, St. Joseph, Mich.

American Institute of Electrical Engineers—Summer convention, Cleveland, June 20-24; Pacific Coast convention, Vancouver, B. C., Aug. 29-Sept. 2. H. H. Henline, 33 West 39th St, New York.

American Society for Testing Materials—Chalfonte-Haddon, Atlantic City, June 20-24. C. L. Warwick, 1315 Spruce St., Philadelphia.

American Society of Mechanical Engineers—Bigwin Inn, Lake of Bays, Ontario, June 27-July 1. C. W. Rice, 29 W. 39th St., New York.

New England Division, N.E.L.A.—Mount Washington Hotel, Bretton Woods, N. H., July 11-13. Miss O. A. Bursiel, 20 Providence St., Boston.

Camp Co-operation XII—By boat to Bermuda, Aug. 3-8. Society for Electrical Development, 420 Lexington Ave., New York.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 7-9. H. A. Buch, Telegraph Bldg., Harrisburg.

Rocky Mountain Division, N.E.L.A.—Stanley Hotel, Estes Park, Colo., Sept. 12-14. G. E. Lewis, 367 Gas & Electric Bldg., Denver.

Empire State Gas & Electric Association—Saranac Lake, N. Y., Sept. 22 and 23. C. H. B. Chapin, Grand Central Terminal, New York.

Illuminating Engineering Society—New Ocean House, Swampscott, Mass., Sept. 26-30. E. H. Hobbie, 29 W. 39th St., New York.

National Electrical Wholesalers Association—Hotel Statler, Buffalo, N. Y., Sept. 26-30. E. Donald Tolles, 165 Broadway, New York.

National Safety Council—Washington, D. C., Oct. 3-7. W. H. Cameron, 20 N. Wacker Drive, Chicago.

Great Lakes Division, N.E.L.A.—French Lick Springs, Ind., Oct. 6-8. T. C. Polk, 20 N. Wacker Drive, Chicago.

Association of Electragists, International—Kansas City, Mo., Oct. 10-12. L. W. Davis, 420 Lexington Ave., New York.

▼

San Joaquin Utilities Ask New Rate Hearing

An immediate rehearing on the order of the California Railroad Commission of May 24 cutting the electric rates charged in the San Joaquin Valley (ELECTRICAL WORLD, June 4, page 971) is asked in petitions filed with the commission by the San Joaquin Light & Power Corporation and the Midland Counties Public Service Corporation. The companies say that earnings under the new rates will not sustain their credit or permit earning preferred-stock dividends.

Concerning agricultural rates, the petition alleges that agricultural consumers do not, even under existing charges for service, bear their fair proportion of the costs of conducting the business. The conclusion is drawn that an order directing the discounting of all bills for agricultural power was made because of the depressed condition of agriculture and not because existing rates are unfair, and that the commission, in imposing rates that do not meet the cost service, exceeded its authority.

▼

New York State Mayors to Weigh Utility Statutes

A comprehensive study of the Public Service Commission law of New York State and all public utility statutes affecting municipalities was authorized last week by the New York State conference of mayors and other municipal officials at its annual meeting in Buffalo. A special committee of five will bring in its report and recommendations at a midwinter session in Albany.

▼

Profit-Sharing Plan in Lieu of Kilowatt-Hour Tax?

To distribute better the taxation burden upon subsidiaries of the New England Power Association in Vermont arising from the tax of 0.5 mill per generated kilowatt-hour, a proposal will be made this summer to the recess tax commission of that state to substitute a profit-sharing plan for the present levy. This plan was announced by F. J. Dunn, general counsel for the association, at a hearing of the commission in Boston June 6, when an entire day was devoted to an inquiry into the financial and managerial policies of the association. At previous hearings in Montpelier representatives of the Green Mountain Power Corporation, Twin State Gas & Electric Company and Central Vermont Public Service Company had testified as to the burdensome nature of the tax, which is expected to bring the state about $250,000 per year.

Much testimony was taken to show the benefits of holding-company management in New England, to which Carl S. Herrmann, treasurer, and Arthur E. Pope, vice-president of the New England Power Association, bore witness. At the next hearing, set for August 8 at Montpelier, it is planned to present extensive exhibits of the effect of the kilowatt-hour tax upon the operations of the utilities under the association's management.

▼

Wisconsin Farmers Clamor for Reductions in Rates

Farmers in Wisconsin have started a vigorous agitation for rate reductions. One of their objects of attack is the municipally owned Kaukanna electric plant, which charges rural subscribers a minimum monthly rate of $4.50, for which they may use 50 kw.-hr., with excess consumption at 3 cents. At a recent meeting 50 farmers signed an ultimatum giving the city until July 1 to put into effect emergency rates or discontinue the farm lines. They demanded a minimum of $2.70 for 30 kw.-hr. and declared that if the city does not meet their demands they will cut the wires. The Public Service Commission has been petitioned for a hearing, but the farmers feel that this will take too long and the petition will be presented to the city as soon as the other 200 rural subscribers have signed it.

A committee of 24 representing rural customers of the Wisconsin Power & Light Company insist upon a flat reduction of $1 in the monthly fixed charge. They refused the proposal of the company that the monthly service charge be cut from $3 to $2 with an increase in rates and will hold out for their own proposal until the Public Service Commission can take action. Present rates are 7 cents per kilowatt-hour for the first 50 kw.-hr. and 3 cents for all over that amount. The company suggested the reduced service charge with a charge of 10 cents for the first 25 kw.-hr.

▼

Ontario Hydro Men Explain Buying Hamilton Utility

Because private power interests, including the Electric Bond & Share Company of New York, were prepared to purchase the Dominion Power & Transmission Company of Hamilton, Ontario, it was in the public interest for the Hydro-Electric Power Commission of that province to acquire the company's holdings. So both C. A. Magrath, former chairman of the Ontario Hydro, and Geoffrey T. Clarkson, for sixteen years its auditor, declared last week before the commission now inquiring into various phases of Hydro administration.

The purchase of the Hamilton company for about $21,000,000 took place in 1930. Since that time there has been general criticism of the price paid by the commission and charges have been made on the floor of the provincial Legislature that "insiders" had profited. Mr. Clarkson stated that, with Hydro facing the need for expenditures totaling approximately $38,000,000 for special plants to provide energy for peak loads which would have cost from $20 to $31 per horsepower, the Dominion Power & Transmission Company's established plant at Decew Falls offered an opportunity for Hydro to gain the needed power at $11.60 and that to effect this saving the temporary acquisition of street and suburban railways and other subsidiary enterprises was a justifiable performance.

Staten Island Edison Plans for Financing

Plans of the Staten Island Edison Company to refund a maturing issue of one-year 3 per cent gold notes with a new issue of one-year refunding and improvement 6 per cent mortgage bonds, due June 14, 1933, will not be adversely affected by the refusal of the Public Service Commission of New York State to authorize the company to issue new long-term mortage bonds. On June 8 the commission denied the petition of the company for authority to issue $8,500,000 principal amount of first and refunding mortgage gold bonds, some of the proceeds of which were to be used to acquire and pay accrued interest on $5,650,000 face value of Associated Electric Company 4½ per cent gold bonds, refunding series due 1953.

The commission refused authorization on the ground that the company would use its credit for the purchase of bonds of a holding company not under the jurisdiction of the commission and not operating any properties within the State of New York. The issuance of the new one-year bonds does not require the authorization of the commission.

▼

Beauharnois Bondholders Appoint Committee

Holders of the 6 per cent collateral trust sinking fund bonds of the Beauharnois Power Corporation have chosen a committee of twelve to represent their interests in consideration of any plan for the future of the Beauharnois power project. Bondholders and proxies at the meeting represented $15,458,500 of the $30,000,000 in bonds outstanding. The committee is to investigate the affairs of the company and formulate plans for the carrying out of the company's undertaking. The Dominion government's assistance would be essential to the reorganization, Arthur F. White, vice-president, said at the annual meeting of shareholders June 8. To carry out its program of construction and power delivery until 1937 the corporation would require $32,000,000.

▼

New England Public Service Votes Dividend Omissions

Directors of the New England Public Service Company, a subsidiary of the National Electric Power Company, voted to omit quarterly dividends on the $6 and $7 prior lien stocks, automatically forestalling payments in four other classes of preferred stock. Inasmuch as the dividends on the prior lien preferred stocks are cumulative, no further dividends can be paid on the $6 and $7 preferred, the adjustment preferred or the convertible $6 preferred stocks until all dividends on the prior lien shares have been cleared up. Payments on common shares were discontinued in March.

▼

Investors' League Protests Insull Securities' Issue

The Utility Consumers and Investors' League has demanded a reopening of the action of the Illinois Commerce Commission in approving bond issues totaling $70,000,000 by the three Insull gas and electric companies in the Chicago area. The league was formed two months ago by citizens of Illinois to protect the consumers and investors of the public utilities. Issue of the bonds, the league charged, would cost consumers heavily.

▼

"Customers Benefited Most," Says Tenney

"In the past ten years the Malden Electric Company has turned over to its customers in rate reductions just twice as much as the sum by which it has increased its dividend," said President A. B. Tenney at a recent hearing before the Massachusetts Department of Public Utilities on the company's prices for electricity. "These rate reductions have saved the customers about $3,000,000," asserted Mr. Tenney, who pointed out that since 1927 the average price per kilowatt-hour has dropped from 8.94 to 7.03 cents, the average consumption per bill rising from 37.1 to 40.5 kw.-hr. Taxes in 1931 totaled almost one-eighth of the total revenue, or 0.62 cent per kilowatt-hour of energy sold. Overdue accounts have increased since 1930 from $68,567 to $112,832 in March last, and the number of overdue customers from 11,074 to 19,896. In 1931 the company gained 771 customers, but it lost 342 in the first third of the current year. Mr. Tenney vigorously opposed further rate reductions at this time on the ground that the credit of the company would be adversely affected by such action.

▼

Utility Defers Dividend

Directors of the American Superpower Corporation have postponed indefinitely action on the quarterly dividends due July 1 on the no-par $6 first preferred and no-par $6 preferred stocks. Both issues are cumulative. The last previous distribution was $1.50 per share made on both classes on April 1.

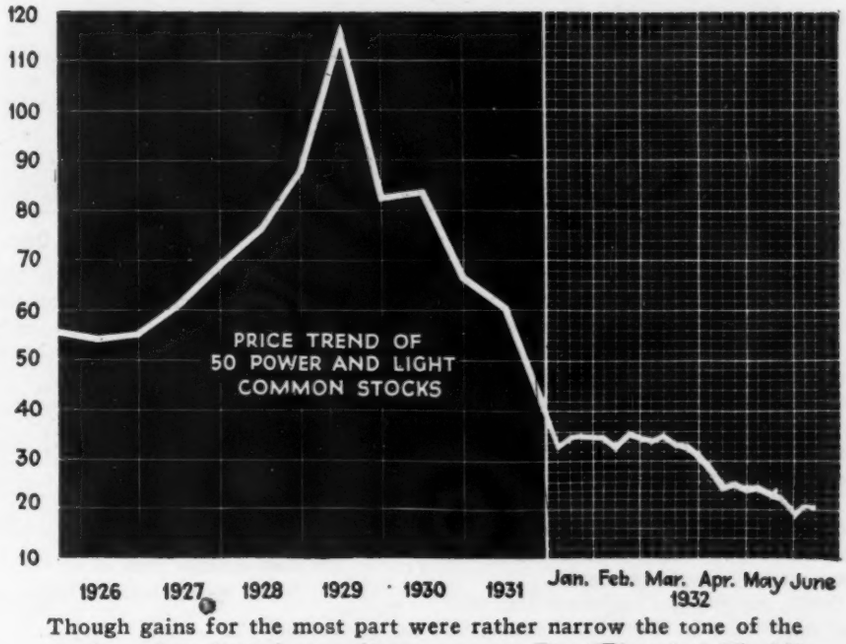
▼

Central Electricity Board Issue

Lists were closed within an hour after opening on the £10,000,000 issue of Central Electricity Board 4½ per cent stock offered in London this week.

▼

Utility Stocks Hold Recovered Ground



Though gains for the most part were rather narrow the tone of the stock market showed some improvement. The "Electrical World" index receded slightly from 20.5 to 20.0, advances in some issues being offset by substantial losses in the Insull group.

British Power Industry Is Flourishing

Output of energy by British public utility plants in April was 13.7 per cent greater this year than last, it is reported by the Electricity Commissioners; 987,000,000 kw.-hr. was generated during the month. The corresponding figures for the first four months of the year were 7.6 per cent and 4,372,000,000 kw.-hr.

Statistics relating to eleven of the principal companies show increases in sales for the six years to 1931, inclusive, ranging from 14 per cent to 420 per cent, the former for the Newcastle Electric, the biggest firm; the latter for the Scottish Power Company. Meanwhile, it is reported that there is a ready demand from investors for new capital offerings, as prospects point to further increase in prosperity of supply companies.

Among the stock issues which have met with success recently have been one by the County of London Electric Supply Company and one by the Scottish Power Company, while the British Power & Light Company, which has just declared a maiden dividend on its ordinary capital, had an unprecedented success with its new preference issue of 600,000 6 per cent £1 shares.

▼

Central-Station Exhibits for Chicago Centennial

Electricity-consuming devices of all kinds in surroundings reproducing their environment in every-day use will be demonstrated in the central-station exhibit in the "Century of Progress" exhibition to be held in Chicago next year. Exhibits for which a contract has recently been closed will be accompanied by demonstrations of the use of electricity in residential, commercial, industrial and farming application as well as by various scientific displays showing illumination relationships.

The electrical central-station committee in charge of this program is composed of E. W. Lloyd, chairman, Commonwealth Edison Company, Chicago; D. C. Barnes, Engineers' Public Service Company, New York; R. J. Graf, Byllesby Engineering & Management Corporation, Chicago; D. C. Green, Electric Bond & Share Company, New York; Louis H. Egan, Union Electric Light & Power Company, St. Louis; Colonel William Kelly, Buffalo, Niagara & Eastern Power Corporation, Buffalo; G. A. Kenney, Commonwealth & Southern Corporation, New York; Clarence L. Law, New York Edison Company, and A. H. Markwart, Pacific Gas & Electric Company, San Francisco.

▼

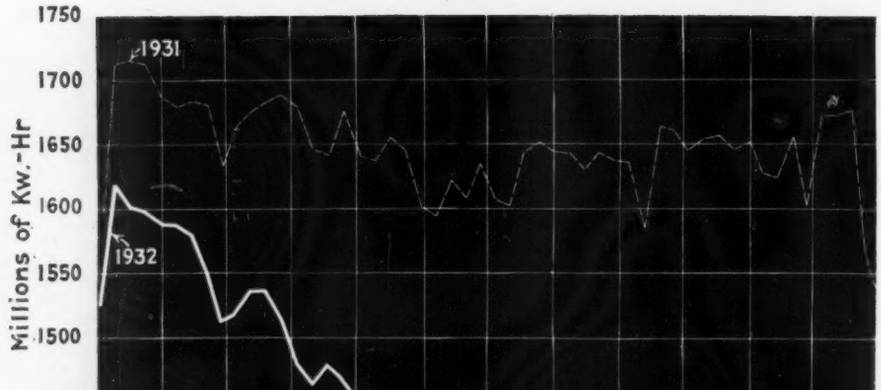
Canadian Output Under 1931

Output of central electric stations in Canada for April fell to 1,334,323,000 kw.-hr., from 1,393,172,000 kw.-hr. in March. The decrease compared with the corresponding month in 1931 was 5.5 per cent; the average daily output was 1 per cent less than in March.

Comparable April figures for recent years, in millions of kilowatt-hours, were, 1929, 1,409; 1930, 1,502; 1931, 1,411.

▼

Output Rises from Holiday Sag



PARALLELING last year's rise, but somewhat exceeding it, electrical energy production by central electric light and power plants for the week ended June 11 jumped to 1,435,471,000 kw.-hr. from the 1,381,452,000 kw.-hr. of the preceding week, which included Memorial Day. This brings the output back to the level of the weeks of May 14 and 21, and cuts the deficiency, compared with 1931, to 11.5 per cent after a series of weeks in which it was somewhat more than 12 per cent.

While the greatest sag from last year continues to be in the central industrial area, still down 14.5 per cent, the showing made by that section is the best since April 16. For the Atlantic seaboard the difference from 1931 is the same as in the preceding week; on the Pacific Coast, also, the gap is very gradually closing, although the latest figure indicates a slight setback.

Weekly Output, Millions of Kw.-Hr.

	1932	1931	1930	1929
June 11	1,435	1,621	1,707	1,699
June 4	1,381	1,594	1,657	1,690
May 28	1,425	1,602	1,660	1,615
May 21	1,436	1,645	1,723	1,705
May 14	1,437	1,654	1,717	1,704

Per Cent Change from 1931

Region	Week Ended June 11	2 Weeks June 4	2 Weeks May 28
Atlantic Seaboard	— 9.0	— 9.0	.....
New England alone	—13.5	—11.7	.....
Central industrial	—14.3	—15.2	.....
Chicago district	.....	.....	.....
Pacific Coast	— 8.9	— 7.4	.....
United States	—11.5	—12.2	.....

New York Metal Prices

	June 8, 1932 Cents per Pound	June 15, 1932 Cents per Pound
Copper, electrolytic	5.33	5.33
Lead, Am. S. & R. price	3.00	3.00
Antimony	5.12½	5.00
Nickel, ingot	35.00	35.00
Zinc, spots	3.15	3.15
Tin, Straits	19.66	19.30
Aluminum, 99 per cent.	23.30	23.30

▼

Electrification Project for Egypt

Three years ago a scheme was projected by a British financial group for the employment of the Assouan Dam to provide electric power in Egypt. The project, resubmitted to the government, is at present being studied.

▼

25,000 Water Heaters Used in Amsterdam

Rented, off-peak water heaters are now extensively used in Amsterdam, Holland, and have notably aided in raising the night load and in reducing the noon valley of the Gemeente-Elektriciteitswerken. From but 895 units in service in 1927 the installed water heaters in this city of 746,000 today total 24,689, of which 84 per cent are rented. Off-peak service is charged for at 0.8 cent per kilowatt-hour. Rental ranges from $0.76 a month for the smaller units to

THIRTY YEARS OF ELECTRICAL EXPORTS

Based upon data compiled by W. C. Becker, Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., and just released, this chart shows clearly the erratic but generally sustained increase in the export of electrical goods of all kinds manufactured in the United States. Post-war years and new-era prosperity furnish the greatest fluctuations.

▼

$1.73 a month for the larger ones and averages 17 per cent a year of the cost as installed.

Automatic control of the water heaters is used to connect them during preferred off-peak hours.

▼

Rubber-Covered Wire by Continuous Process

What is said to be the first successful continuous-process insulating of rubber-covered wire is now in effect at the Baltimore, Md., plant of the Western Electric Company. Here No. 14 code wire is run off complete at 400 ft. a minute and smaller sizes, such as Nos. 19, 20 and 22, may be produced at 600, 600 and 1,000 ft. a minute respectively.

Advantages of the process lie in the economies of production space and time realized and in the close control of insulation quality which is possible in subjecting all the wire in process to precisely the same conditions of time and temperature. As the result of using an accurate and inflexible tool head it is possible to produce such wire with outside diameters only 3 per cent greater than the minimum permissible diameter and without imposing a burden of watchfulness on the operator.

Vulcanization takes place in the time required to pass the insulation through the 100-ft. long vulcanizing tube. During this interval the covering is exposed to an atmosphere of saturated steam maintained at a pressure of 200 lb. per square inch.

A high potential is applied to the two lengths of electrode so that, as the wire is being coiled, a running test for the continuity of the insulation is made. If a fault occurs a current flows from the electrode to the grounded conductor, which serves to operate certain relays, which in turn stop the machine.

▼

Materials for P. R.R. Electrification

Electrification of the Pennsylvania Railroad between New York and Washington will require the use of about 68,000 tons of steel, 38,000,000 lb. of copper, 120 large transformers, 100 small transformers, 530 circuit breakers, 176 new locomotives and alteration of 36 existing locomotives. The construction involves 30 new substations or switching stations and the extension of twelve existing stations, the placing of some 8,000 steel poles on concrete foundations and the stringing of approximately 6,500 miles of wire in the electrification of 1,082 miles of track.

▼

Westinghouse Employee Sales Total $1,503,268 in May

Sales numbering 35,607 and totaling $1,503,268 in value were made by the 35,000 Westinghouse Electric & Manufacturing Company employees during May in a sales campaign in which each employee was pledged to sell at least one Westinghouse electrical appliance. Nearly a dozen other companies of nationwide scope have now inaugurated similar drives.

▼

Delinquent Electrical Accounts

(National Electrical Credit Association)

Number of Accounts Reported

Division	May 1931	May 1932	Per Cent Inc. or Dec.	Five Months 1931	Five Months 1932	Per Cent Inc. or Dec.
New York	199	252	+26.6	1,360	1,177	—13.5
Middle and Southern Atlantic States	133	94	—29.3	666	564	—15.3
New England	69	94	+36.2	460	574	+24.8
Central	540	424	—21.5	3,178	2,574	—19
Total	941	864	—8.2	5,664	4,889	—13.7

Total Amounts Reported

New York Division	$23,282	$25,148	+ 8.0	$170,788	$117,197	—31.4
Middle and Southern Atlantic States	11,830	11,510	— 2.7	83,377	53,339	—35.9
New England	7,538	6,643	—11.9	43,340	43,327	—.03
Central	48,682	33,492	—31.2	290,121	199,450	—31.3
Total	$91,332	$76,793	—15.9	$587,626	$413,313	—29.7

Major New Construction This Week

TRANSFORMERS, power substation equipment, heavy-duty motors, controls and conveyors will be installed in terminal of Memphis (Tenn.) Bonded Warehouse Company. Cost over $800,000.

Motors, pumping machinery, auxiliaries and loading equipment will be installed in bulk oil storage and distributing plant of Standard Oil Company at Quincy, Mass. Cost about $900,000.

Department of Public Affairs, Newark, N. J., has ordered call for bids for wire, wire supports and complete electrical equipment, including signal system for new city railway lines, in course of construction.

Crosley Radio Corporation plans largest broadcasting power station in country at Mason, Ohio. Cost, complete, for 100,000 to 500,000-watt service reported over $400,000. Permit granted.

Machine drives, heavy-duty motors, transformers, etc., will be installed in oil refining plant of Shell Oil Company, Vancouver, B. C., on 80-acre tract near city. A $1,000,000 project.

Transmission lines, transformers and power substation equipment, pumping machinery, electric generating equipment, etc., to cost over $5,000,000 will be required for project of Metropolitan Water District, Los Angeles, Calif., extending from Boulder Canyon, Nev., to Los Angeles.

Bids for motor-generator sets are being asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 21 (Schedule 8131).

New transmission lines, rebuilding and improvements to cost over $400,000 planned by New Brunswick Electric Power Commission, St. John, N. B.

Shot-Welding Process Licensed to Manufacturer

Release of the spectacular new shot-welding process for more extended use in the fabrication of stainless steel structures is announced by the Edward G. Budd Manufacturing Company, which has negotiated a contract with the Steel Corporation.

Under this agreement stainless steel will probably gain wider use in ship construction, where its qualities of resistance to rust and salt water corrosion will make it valuable. In building it may be used on upper floors where a light metal is needed and for outside trimming. For bridge construction its lighter weight makes further construction economies possible. General industrial potentialities for use are great.

Perfection of the shot-welding process (ELECTRICAL WORLD, March 12, 1932, page 481) has only recently made the extensive use of stainless steel practicable.

Progress of Pennsylvania Inquiry

Completing the first step in the statewide rate inquiry, the Pennsylvania Bureau of Accounts and Statistics is turning in to the Public Service Commission's special committee its report on the Duquesne Light and West Penn Power companies. The bureau will now proceed with an inquiry into the rates of the Philadelphia Electric, Scranton Electric, Pennsylvania Electric and Pennsylvania Power & Light companies. These reports are based only on book values and historical costs, and any reductions brought about will necessarily be through voluntary cooperation of the companies.

▼

Iowa Utility Changes Name

The name of the Iowa Railway & Light Corporation, Cedar Rapids, has been changed to the Iowa Electric Light & Power Company, to indicate operations more in line with activities of the company, which serves 90 towns and villages.

▼

Rural Extensions in New York

Despite business conditions, the New York Power & Light Corporation has been active in the past five months in the construction of rural lines, 38½ miles having been added to serve 342 new customers. The corporation now has more than 36,000 rural customers. New extensions, of which there are more than 100, have been made in all districts of the company in eastern New York, including those tributary to Albany, Amsterdam, Troy, Schenectady, Hudson and Glens Falls.

▼

Utility Taxation in the Capital

Representatives of the utilities of the city of Washington are opposing the Capper bill to change the system under which they are now taxed. The tax is now 4 per cent and in some cases 5 per cent of the annual gross revenues in lieu of the personal property tax. The Capper bill proposes to change this to an ad valorem tax on personal property plus a 2 per cent tax on gross revenues.

▼

Rate Turmoil in Indiana Continues

Dismissal of a petition from the Northern Indiana Power Company for permission to establish a central Indiana power loop with standard rates, similar to the one established temporarily in southern Indiana, was the chief action at the last meeting of the Indiana Public Service Commission. The commission based its action upon a federal court decision which held that the municipality is the unit for rate making and not the utility's entire system (ELECTRICAL WORLD, February 27, page 382). Forty-nine towns in north central Indiana, served by Insull lines, are demanding lower rates, as are places in other parts of the state, and agitation for municipal plants continues, Crown Point citizens having just voted to establish one.

▼

"The most perplexing, the most humiliating and alarming subject which the world today has to consider is unemployment. Will this condition continue? Certainly not in its present intensity; but there are reasons for believing that the United States will never require as many hours of labor as in the past.

"It must be regarded, or at least it should be regarded, as a blessing if we are forced to work less hard for our daily bread.

"Dare we adopt a less austere guiding principle — that work is not the aim of existence but rather that man was created to enjoy as well as to labor? If we accept this conception we can believe that we are entering upon a new dispensation in the intellectual and moral world as well as upon a new era in our economic life."

THOMAS S. BAKER,
President Carnegie Institute of Technology

[**Dr. Baker so addressed the graduating class of Carnegie Tech at the commencement this week.**]

▼

Connecticut Adds Utility Securities to Legal Suit

The following electric light and power securities have been added to the list of legal investments for savings banks in Connecticut, according to the revised list recently issued: Brooklyn Edison Company general mortgage, series E, 5s, 1952; Duquesne Light Company first mortgage 4½s, 1957; New York Central Electric Corporation first 5½s, 1950, and New York Edison Company first and refunding, series C, 5s, 1951.

▼

Vermont Utility Structure

To simplify operations in Vermont, the New England Power Association has arranged for the Green Mountain Power Corporation, serving the Burlington-Montpelier district, to take over the areas formerly served by the Fall Mountain Electric Company, the Vernon and South Vernon Electric companies in the southern part of the state. The New Hampshire territory of the Fall Mountain company will be served by the Grafton Electric Light & Power Company, with headquarters at Lebanon, N. H. Bellows Falls, Vt., is the principal city added to the Green Mountain company's territory. Ralph N. Hill, vice-president and general manager, will have jurisdiction.

Asks Special Rate to Keep Customer

Whether an electric utility may grant a special temporary rate to an industrial firm to prevent it from erecting its own power plant is before the Alabama Public Service Commission. The Birmingham Electric Company seeks approval of a preferential rate for a cotton mill which held that it could not operate and pay the regular rate of about $5,000 a month. Those seeking to erect a power plant for the cotton mill maintain that the proffered rate is discriminatory and amounts virtually to a rebate at the expense of other large industrial users. The new rate offered is said to be about 25 per cent lower than the standard rate.

▼

North Manchester, Ind., Loses Suit

Suit brought by North Manchester, Ind., to acquire by condemnation proceedings the property of the Northern Indiana Power Company (ELECTRICAL WORLD, January 16, page 128) has been decided against the city of Circuit Court. The suit asked the vacating of an order of the Indiana Public Service Commission dismissing the city's petition. The court held that the resolution of city officials authorizing the condemnation proceedings was not submitted to a vote as provided by law. Because of the fact that this was the first action of its kind by an Indiana municipality under provisions of the Shively-Spencer utility act the case caused wide attention.

▼

New England Convention Program

When the New England Division of the N.E.L.A. meets in annual convention at Bretton Woods, N. H., July 11 to 13, addresses are expected at the general session from George B. Cortelyou, the new president, and B. F. Weadock, the new executive director of the association, as well as from Senator G. H. Moses of New Hampshire. At the banquet P. S. Arkwright will talk about the range campaign and Merle Thorpe, editor *Nation's Business*, is also scheduled to speak.

▼

New Hampshire Utilities Case Up

Oral argument has started before the New Hampshire Supreme Court in the widely advertised suit of the State vs. New Hampshire Gas & Electric Company and the Derry Electric Company, units of the Associated Gas & Electric System. The case, which has been a subject of agitation for about two years, concerns the jurisdiction of the commission and the proper sphere of holding companies. (ELECTRICAL WORLD, March 26, page 556.)

Feebly Magnetic Materials Separated at Lower Cost

Final tests have recently been completed on a new type of magnetic separator which has been designed to combine great capacity with a separating intensity heretofore considered unattainable. The results as announced by the Dings Magnetic Separator Company laboratories in Milwaukee indicate that the machine has successfully removed slate from coal, mica from feldspar, iron oxide from bauxite, dolomite from gypsum, oxides of iron and imbedded oxide particles from silica, sand, etc.

There are said to be some forty-odd minerals in addition to iron that are magnetic to a certain degree. It is admitted that most of these materials could not be separated without the perfection of a machine with super-high magnetic intensity. As compared with the limited size and comparative high cost of previous separators for feebly magnetic materials, such a unit may (1) enable many producers to get premium prices for improved purity in their products, (2) bring about a reduction of cost for products or materials that now require separation as an absolute necessity, and (3) make separation and purification practical and profitable for mineral deposits never before utilized.

The magnetic zones developed represent a field strength of 18,000 gauss. The magnetic effect is produced by a massive horseshoe-type electromagnet, the pole pieces of which are tapered. Interposed between the poles and the bridge bar are laminated rolls on which the materials to be separated pass.

▼

Improved Joints Can Reduce Cable Failures

Recently devised for use by the Union Gas & Electric Company of Cincinnati, Ohio, a new type of joint for 69-kv. type "H" 500,000-circ.mil cable has been functioning satisfactorily since August, 1931. According to E. F. Neuzel of the Columbia Engineering & Management Corporation the maximum stress gradient of 143 volts per mil on the insulation occurs at the surface of the conductor at the end of the factory-applied ground shield and decreases as the stepping is approached to a value of about 70 volts per mil at the conductor under the first step.

In this joint the average value of longitudinal stress is less than 5 kv. per inch, while the average value of maximum radial stress is about 68 volts per mil. It is Mr. Neuzel's contention that if joint failures were stated on a mileage basis it would be evident that failures occur in joints with more than 60 times the frequency of their occurrence in cables and that, therefore, a cable joint should be at least as strong as the cable length it joins if failures are to be greatly reduced.

Power-Company Supply Drives Electric Ferry

Said to be the first of its kind, the recently inaugurated electric ferry service across the Sacramento River at Glenn County Road, near Princeton, Calif., marks a notable departure in such transportation practices. The Sacramento is a navigable stream, and the trolley system has therefore been devised so that whenever a boat is to pass the power cables can be lowered to the riverbed.

The biggest problem was the trolley system, consisting of the main upstream supporting cable insulated with a ring of insulators at each end. The two ferry support sheaves also are insulated from the ferry, and a weighted trolley wheel running between the two sheaves supplies the power to drive the motor. The ground return goes through a special mercury cup on the drive shaft and then through the grounded drive cable.

Relatively simple, the drive consists of a reduction gear with figure 8 cable sheaves, a 5-hp., 1,200-r.p.m., reversible, single-phase motor and starting and magnetic reversing control. The boat speed is approximately 180 ft. per minute, the crossing being made in less than two minutes. The total cost of operation is estimated conservatively to be one-half that of the formerly used gasoline engine ferry, and operation to date, according to L. O. B. Lindstrom of the General Electric Company, has more than justified this estimate.

▼ ▼ ▼

Laboratory Lightning Doubled in Voltage

Left—10,000,000-volt artificial lightning discharge. Right—1,000,000-volt, 60-cycle, three-phase discharge

TEN million volts were produced last week at the Pittsfield Works laboratory of the General Electric Company by a lightning generator designed under the direction of F. W. Peek, Jr. Equipment is said to be capable of forming a 60-ft. arc. Mr. Peek stated that the generator has a capacity of 50,000,000 kw., which is discharged across a sphere gap in one microsecond, and that the maximum current delivered during the discharge after the resistance of the air has been broken down is 50,000 amp. In 1929 an artificial lightning discharge of 5,000,000 volts was attained at the Pittsfield plant. In a similar demonstration a 1,000,000-volt, 60-cycle, three-phase arc was also produced.

EDITORIALS

L.W.W.MORROW
Editor

Engineering Council serves well

THE American Engineering Council is doing for the engineer members of the participating societies a task that is none too well appreciated by the rank and file. All bills poured into the congressional hopper that directly affect the engineer, the security of the profession or the sanity of governmental expeditions into engineering economy—and there are scores of them—are scrutinized by the council or its executive committee. A recent report listed seventy-eight measures over a wide range of incidence on governmental construction programs, conservation, patents, federal research, education, aviation, civil service, economy moves, economic recovery and stabilization.

How could the individual engineer or even the several individual societies hope to follow all these schemes, let alone express a unified attitude on them? How more effectively give the profession of engineering a rising prominence and solidarity before the nation's representatives? How better scotch those fantastic proposals and raids on the treasury insinuated into the grist of bills by scheming minorities who prevail on unenlightened legislators to sponsor them?

"Built-in" highway lighting

NEW YORK, Massachusetts and Maryland have passed laws recognizing the necessity for lighting important highways of motor traffic along modern lines. In the first-named state a joint legislative committee has an investigation in hand covering this subject; Massachusetts has legalized the installation of a unit section which may become a yardstick for many miles of future interurban lighting construction, and in Maryland the State Roads Commission has been empowered to adopt suitable highway illumination. Interest is mounting in the subject and deservedly so.

It is too early to settle on a closely restricted standard for national application, but it is time to make sure that illumination will be classified among the necessities of highway design and to take steps to provide for flexible and satisfactory installations by building into these roadways at the time of construction suitable longitudinal and lateral conduits and conduit for the lighting of overpasses, underpasses, ramps, traffic circles, street crossings and other special layouts. To provide for eventual longitudinal lighting it would not seem burdensome to include in the original road construction at least a two-and-a-half-inch electrical conduit from side to side in the permanent roadway at 500-foot intervals. It is even advisable to try longitudinal surface lighting of roadways by means of a center illuminated raised trough that may divide traffic lanes as well as provide lighting. Highway lighting should be an integral part of road construction.

Induction-motor design versus performance

SURPRISING discrepancies from the specialist's standpoint exist between computed and tested values in induction-motor design, considering the refinements achieved by manufacturing engineers in the past twenty-five years. R. E. Hellmund told the A.I.E.E. Providence convention that one cause is decreased motor size per unit of capacity, which tends to bring about increased flux densities and greater leakage fluxes. The effect of higher saturation apparently deserves more consideration from designers, especially in machines with partly closed slots. Core

losses at full load differ from those incurred at no load. Mr. Hellmund assumed the extreme case of complete saturation of the tooth tips under load condition by the combined effect of main and leakage fluxes, recognizing that at no load the main flux alone does not bring about an appreciable saturation of these parts. Under these assumptions many of the conditions under load approach those obtained with open-slot machines. The magnetizing current of the main flux under load rises, and the resulting power factor differs from that calculated from no-load conditions.

No criticism of the newer designs was intended by Mr. Hellmund, who did well to emphasize the cost reductions gained along with the reductions in size and greater ease of application now available. The discrepancies between calculated and test results under load loom larger because of increased refinement of design. The objective is a more penetrating understanding of the obscure factors in design and performance, so that greater precision in the use of material and in the prediction of results can be realized.

Burdensome allowances for second-hand apparatus

COMPETITION for apparatus business has become so keen that in some quarters manufacturers are being tempted to make economically unwarranted concessions in terms in order to keep production departments at work more hours per week. In a recent sale of distribution transformers the successful bidder stated that he was obliged to allow about 20 per cent of the net billing price to the purchaser as a credit on old transformers removed from the system and that these could be sold with difficulty to the junk dealer with a resulting yield of only 8 to 10 cents per kva. The low price of copper dampened the enthusiasm of the junk dealer for forcing the copper out of the cases with a crowbar and returning the name plates. The sales department of the manufacturer contended that this allowance to the buyer for his discarded equipment represented a loss of all profit on the sale, the junk value being but 1 per cent or 2 per cent of the allowance.

Business taken on such a basis benefits neither the purchaser nor the manufacturer. It undermines a stable industry. Stringent economies are demanded by purchasers under present conditions, but we do not believe the power industry has reached the point where it either needs or desires to buy equipment on terms which fail to yield a fair profit to the seller, nor will manufacturers who sell on this basis long survive. If such conditions become general, the result can but be harmful. Concessions of this kind deserve severe analysis, and proper action should be taken by buyers and sellers when necessary to insure prices and terms fair to all concerned.

The first job for the electric range campaign

IT IS a fair statement that the most difficult task that will be encountered in the electric range campaign will have to be accomplished before the campaign starts.

Among distributors, dealers and contractors there is today a lack of confidence that the range market is now ripe for development. There is doubt as to the sincerity of the power companies in inviting the trade to participate in the range business. For if they are to benefit, margins must be ample and selling costs low enough to permit them to make money on range sales. They must be assured that local demand can be built into a lasting business for them. And they must be convinced that the problems of installment financing and services will be provided for. After having so largely controlled range distribution and marketing for twenty years, they wonder if the utilities appreciate the changes in local policy that will be necessary in many cities to put the development of the range market upon a really co-operative basis.

The Electric Cookery Council, organized by the N.E.M.A. and the N.E.L.A. to conduct a national campaign to sell electric ranges, is calling upon the entire electrical industry for enthusiastic support—which today does not exist. The first step in the campaign must be to overcome this apathy or prejudice in preparation for a co-ordinated approach on the consumer market. The program itself must be sold to all classes of electrical men, before they can be taught how to sell ranges. This job should be thoroughly organized and carried through at once.

Utilities and Public Welfare*

The author discusses primarily the human and public side of the utility business rather than the pure economics. As a result there are some excursions into ethics, morals and points of view on public questions. He divides his discussion into relations with employees, customers, government and security holders.

FLOYD L. CARLISLE
Chairman of Board
Consolidated Gas Company of New York and
Niagara Hudson Power Corporation

THE most important object of organized society is to promote the public welfare. This is not alone the purpose of government, but is the ultimate object of all individual, group and corporate endeavors. Our business undertakings are not an end in themselves, but the means to an end. The doctrine of the widest freedom of individual initiative is predicated upon the belief that this is the best policy for society as a whole.

The electric light and power business is complicated, scientific and very much specialized, but at heart it is simple. Our corporations are creatures of the various state governments and are chartered to generate and distribute electricity at fair and reasonable prices. That is the formula for the management of our corporations to follow. Efforts to evade or circumvent that formula are fundamentally dishonest, not to say stupid and asinine, and, furthermore, such efforts are wholly bad business. Such public criticism against the industry as is deserved and merited has very largely had its origin in efforts made within the industry itself to avoid that formula. Under the guise of management and supervision contracts, efforts have been made here and there to charge the operating companies with unreasonable and improper costs. This practice has not been general within the industry nor representative of its best management. In my judgment, it is the duty of this association to take an active hand in stamping out such practices.

I am very happy tonight to know that this association has gone back to first principles. We have become, by the changes in our constitution and by the clear expression of our membership, a pure trade association. There is a great work that we can perform which will be truly for the public welfare. This is the proper forum for the exchange of the most exact and scientific knowledge concerning our business. Our statistics, compiled from no other standpoint than the exact truth, can be helpful to governments, to industries, to banks and to investors, as well as to ourselves. Any taint of propaganda, of lobbying, of trying to color facts or to influence any one except with facts is definitely, and I hope permanently, ended in this association. I believe, furthermore, that we must enforce the highest ethical and business practices within our membership. I repeat that the purpose of this industry is the generation and sale of electricity at fair and reasonable rates and no other, and that any company violating that purpose should not be permitted to remain within this association.

Relationship with employees and customers

The relationship between the employee and the corporation for which he works, next to his family relationship, is the most important and intimate thing in his life. From it the employee derives his living, supports his family, educates his children and looks for help in sickness and disability. In turn, the corporation can only function through the human beings that constitute its body of employees and its success or failure is dependent upon them. In the growth of the modern corporation I have had but one worry; that is, by reason of mere size, the intimate and human contact between the employee and the corporation might be lost. This, however, is a matter of management. By reason of size, and the greater financial stability which ought to go with size, the employee can be safeguarded much better than by the small insecure financial unit.

It seems perfectly clear that no corporation has successfully performed its work in the world unless its employees receive fair and adequate compensation, that competent employees are reasonably secure in the permanence of our employment, and assuming that the business prospers, that provisions for sickness and disability are made.

*Presented before N.E.L.A. convention.

This is an ideal toward which we should move. On the part of the employee, he is bound to give to the corporation the full measure of his work and ability and to hold toward it the greatest of loyalty. Within the electric light and power business, viewing the stability of its earning power and the nature of its business, it would seem possible to carry out effectively such relationship with its employees.

The relationship of the company to its customers concerns many things, but principally service and rates. To give service, the industry obviously must provide itself with generating plants, transmission lines, distribution systems, working capital and personnel. One of the unique and distinctive features of the electric light and power business has been the increasing demand for service, requiring a constantly expanding plant. Even during the distressing times through which we are passing, extensions are steadily being required to furnish new service to our increasing population.

Whatever may be the future judgment of the period following the end of the World War to the present time, within our industry one great fact will stand out, which is that during that period the industry built itself practically anew and brought into being the most efficient and scientific machine ever devised for furnishing a great social need. For the ten-year period ending 1930, $7,389,000,000 of new capital was raised and expended, 22 per cent on steam generating plants, 10 per cent on hydro-electric plants, 14 per cent on substations, 16 per cent on transmission, 26 per cent on distribution and 12 per cent on working capital and miscellaneous. Nowhere in the world is anything even approaching the magnitude and character of this great plant and, unlike most industries, it has expanded very little beyond present needs. Practically everywhere within the United States cheap electricity is available both to the large and small centers of population, including its rural sections. There may be complaints of rates and various things, but there can be no complaint of the adequacy of the service. During this period of growth, the course of rates has been downward.

The enormous growth of the industry has not been made at the expense of the customer, but to his profit. In the year 1902 the gross sales of electricity amounted to $84,000,000; in 1912, $287,000,000; in 1922, $1,020,000,000, and in 1931, $2,137,000,000. Such a growth could only have been possible predicated upon the prosperity of the consumers using this energy and the fact that it constituted a tremendous saving to them. Great tribute must be paid to the skill within the industry in developing markets. Industries which could supply themselves with their own energy have in recent years become the customers of the central-station companies.

It has always been a matter of controversy with some critics of the industry that power was sold to industrial customers at too low rates. This is not the place fully to develop this subject, but, in a general way, the cheapness of electricity to the customer depends upon the maximum use of the generating and distributing plant. Industries have filled the valleys of generation, and in practically every case where great industrial markets have been developed the rates to other classes of customers have been lowest.

I had compiled for the purpose of giving an example of the varying rates between industries and other consumers a table of rates. We will assume that contiguous to Niagara Falls there is an industry operating 365 days in the year, 24 hours per day; another operating on the basis of eight hours, 5½ days a week; a commercial customer operating up to the average of commercial customers of the country and a residence using electricity for lighting, cooking and refrigeration. Assuming that each customer used one kilowatt of energy and that there was no cost of transmission or distribution to him, the effect would be as follows:

Class of Service	Yearly Use of Demand Hours	Yearly Load Factor, Per Cent	Rate per Kw.-Hr. Cents
Special industrial	8,760	100	0.30
Ordinary industrial	1,530	17.5	1.71
Commercial	945	10.8	2.78
Residential	612	7.0	4.28

Of course, the true picture would be to include the cost of transmission and distribution, but throwing that out, the 100 per cent load factor customer paying 3 mills per kilowatt-hour for his energy would be on the same basis as the residential user paying 4.28 cents per kilowatt-hour for his energy, and the company's profit would be the same from each consumer.

In discussing the relation with our customers, I wish to mention briefly the problem of taxation. Prior to the new tax bill the industry has been paying approximately 10 per cent of its gross income in taxes and every year it has been a constantly growing item.

I am not saying for a moment that the industry should not pay its proper and fair proportion of the taxes of the nation, but it is very difficult for the management of the industry to project descending rate schedules upon increasing tax burdens.

The industry is constantly threatened in some quarters with experiments in government operation. I rather assume that the burden of taxation for the moment is so great that little will be heard from these quarters, but I have always been glad to welcome a comparison of the well-managed, privately owned and regulated companies with government or municipal operations. I am very sure that an honest comparison anywhere on the North American continent would demonstrate that the regulated utilities are doing a better job and at lower rates, all factors, including taxation, being taken into consideration, than operations of plants by municipalities or governments.

Until we have emerged from the present depression, it is difficult indeed for any one to forecast the probable future of rates. Forces beyond our control are so potent at the moment that we cannot see clearly into the future. Every officer of a corporation who is worth his salt is anxious to have his company prosper with low rates charged for the service. Earnings founded upon low rates and wide uses of service are much safer than those predicated upon high rates. The most potent factor in the downward course of rates lies in the ability and competence of management, the proper exercise of good judgment and the sane application of sound economics, rather than legalistic theories of rate making or in rate proceedings themselves.

Our customers are very often partners as stockholders in the business. Any customer who has a deposit in a

savings bank or possesses a life insurance policy is in a very real sense a part owner in the business. Whether or not he is such a partner, he is deserving of every courtesy and frankness. If he thinks his rate is too high, give him the facts and reasons for the rate. It is possible he may agree with you, and I hope if you are wrong he will convince you of that fact. Your customers range from a workman living in a one-room flat to great industries, railroads and municipalities lighting many miles of streets. Each customer is deserving of the same equitable treatment, the same frankness.

Relation to government

Our corporations are creatures of the state governments and limited in their powers from the date of birth. There is even a ritual for burial after death. Our most important contact is with state regulatory boards. Our rates are generally subject to their approval. Our accounting for capital purposes and for operations are matters of scrutiny, analysis and, within certain limits, approval.

Generally speaking, the companies have the responsibility of management and the public service commissions the administration of statutes. This division of responsibility is, I believe, fundamental and necessary to preserve, if sound economics are to rule.

The mere fact that the state regulatory boards fix rates does not mean that they guarantee that the customers will pay those rates or use the service. The industry must rely upon the fact that the public will use its service because it is economical to do so. Business is not static. Conditions change. The industry must adapt itself quickly to such changes and the responsibility for such decisions must lie in the management.

Regulation would be destroyed if the point of view of the public service boards were political. The soundness of the industry would be destroyed if commissions did not make their decisions based upon facts. All that the industry asks of the state regulatory boards is fair and just treatment, based upon nothing except the formula that the companies exist for the sole purpose of generating and selling electricity at fair and reasonable rates, no more, no less.

There are people within the country who believe that the federal government should to some degree fix rates. This is based primarily upon the theory that wherever electric energy crosses state lines it is interstate commerce and can only be regulated by the federal government. The proportion of the total energy used in the country which crosses state lines is small. After it crosses state lines its price to the consumer is fixed or may be fixed by the state commissions. Personally, I doubt the wisdom or necessity, viewed from the standpoint of the public welfare, of injecting a new rate-making factor into the situation. The Federal Power Commission has to do with licensed water-power developments and is now engaged in making a study of the entire industry. The Federal Trade Commission has been for years engaged in an examination of the industry. Special committees of Congress and of the various states are almost continuously investigating this or that phase of our business.

While I admit that the multiplicity of commissions and investigations is costly and trying, I do not think we should oppose them. There is nothing fundamentally wrong with the American practice of regulating electric utilities. The criticisms and improper practices represent but a small part of the total. With patience and with frankness we should conduct our relationships with government. There is no necessity for concealment and I believe the open forum is the safest place in which our problems can be discussed and settled.

To say that this has been a distressing time viewed from the reported market price of securities, including our own, is to put it very mildly. It is difficult for me to believe that present so-called market values reflect anything even approaching real values. The forces that have led to the world-wide collapse of security values are by no means clear and certainly are very little related to our particular business. The securities of our best operating companies have not been immune from the general market decline.

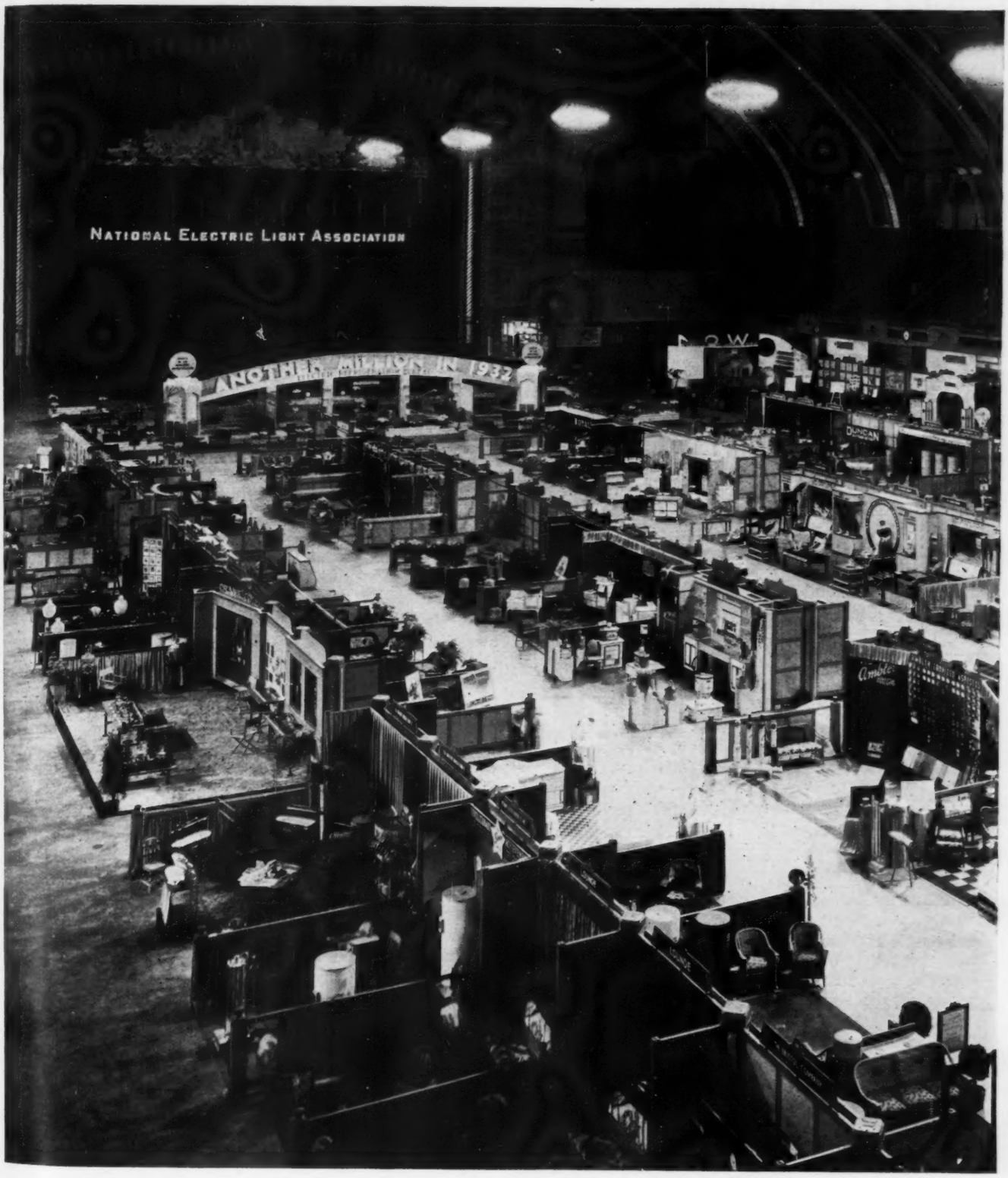
I am loath to discuss the holding company because the confusion of the moment can obscure any one's judgment. Grave errors of judgment have concededly been committed by some public utility holding corporations, but that by no means establishes the fact that all holding companies, *per se*, are against the public interest. It is the kind of financial set-up, the relation of debt to properties, their earning power, and the character and point of view of management, that distinguishes one from the other.

Holding companies are primarily corporations that own securities rather than fixed property. The government has not hesitated to create such corporations. The Reconstruction Finance Corporation is one. The Federal Land Banks are others. As in all human endeavors and undertakings, it is not so much the form as the substance and character of management that counts. The properly financed and properly managed holding company has in the past and will be, in my judgment, in the future a very potent instrument for the public welfare.

I think it is perfectly proper and under these auspices to assure the investors in the sound companies of this industry that there is no cause for alarm. This industry is fundamentally sound. It supplies one of the great economic necessities of life. It supplies it to the user at prices that he can afford to pay and profit from. No industry within America has maintained its earning power better than the electric light and power business. Our plants are modern and are susceptible of supplying a much larger demand with small capital additions. This is no time to take counsel of our fears.

Let me conclude with the suggestion that as you go back from this convention to the various parts of the United States you do so with courage. Do your several jobs better than before. Look up, not down. Mix your deeds with more humanity. We need everywhere less hate and more kindness and toleration. Let the old virtues of simplicity, honesty, plainer living and higher thinking be your guiding stars.

Exhibitors Encouraged at Atlantic City



Much doubt and gloom was associated with the plan to hold an exhibition at the N.E.L.A. convention this year. This was quickly dissipated by the interested visitors to the convention. Many manufacturers said this was one of the best exhibitions held in years and those viewing the exhibits showed great interest in the new developments. It is sound business policy to have exhibits each year

4-Ton Induction Furnace Installed in Midwest

A 4-ton coreless induction furnace has been recently put in operation in the Chicago district which is capable of melting 40 to 50 tons per day. This unit is almost double the size of any coreless melting furnace previously installed. Most of the units which have been installed in the past seven years are rated at 100 to 2,000 lb. capacity. The new unit is designed to melt low-carbon stainless steel scrap, ferro-alloys for addition to larger furnaces and metal for ingots of high-quality tool steel and other alloys.

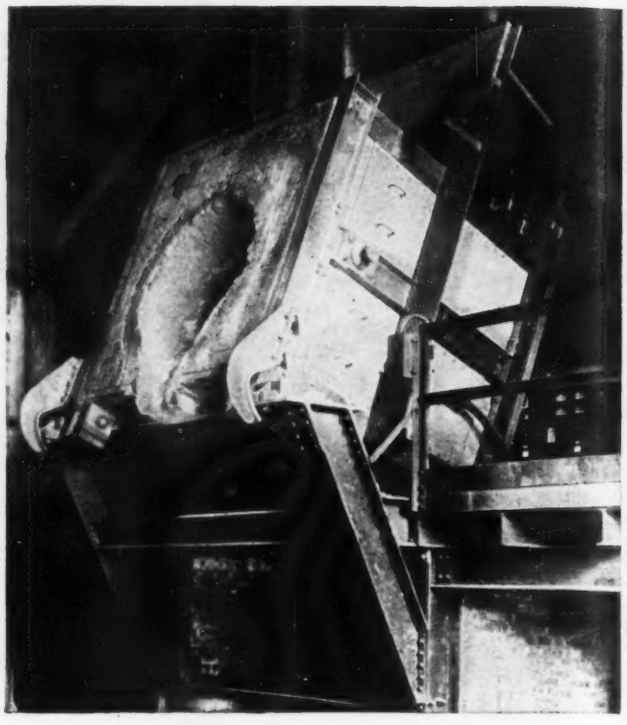
Essentially the furnace is an air transformer, whose primary is a single-layer helix of water-cooled copper tubing and whose secondary is the metal charge. Power from a 1,250-kva., 1,000-cycle generator induces currents to circulate in the outer part of the charge, thereby heating it. No electrodes are used.

The charge is stirred as much or as little as desired by electrical forces within the bath. Metal can be melted rapidly and with very little wear on the lining. No elements in the charge can be volatilized because no part is hotter than the bath, the temperature of which can be controlled by regulating the power input. The furnace housing operates with a temperature rise of only a few degrees, and then only where it is closest to the coil. The lining life is reported as satisfactory while melting USS-18-8 and other high chromium alloys.

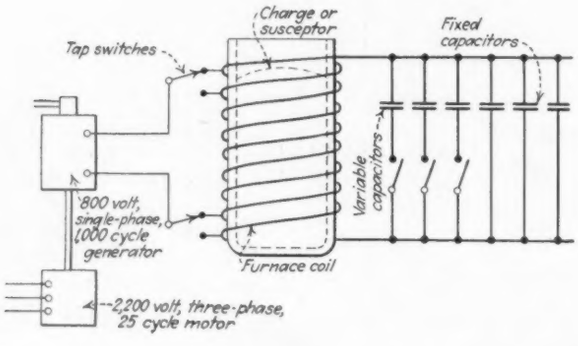
Stirring of the charge is effected by the forces produced by the main furnace coil without the use of any auxiliary winding. The circulation of the bath is caused by mutual attraction of current elements in the outer part of the bath. Any one who has seen a loosely wound helical coil spring suddenly energized with heavy current and seen it snap together as though hit a quick blow on the end will understand how the current elements cause the stirring. The resultant pressure of these current elements is toward the axis and is most intense at the axial center of the coil.

There is another force causing stirring, namely, the repelling force between the current in the charge and that in the coil. If the coil is symmetrically arranged with respect to the charge in an axial direction the repelling force is merged with the attractive force in the bath. If, however, the coil is displaced along the axis, the repelling force of the coil and bath may become quite noticeable and to some extent counteract the attractive force in the bath.

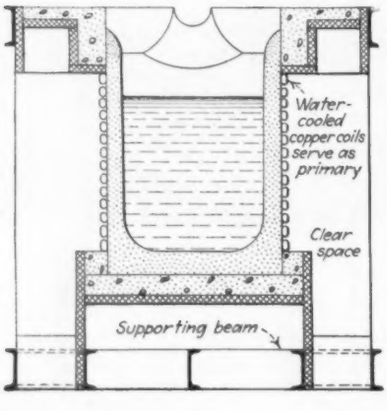
Water-cooled tubing, interlaced to reduce reactance, conveys the power to the furnace. It is reported that this is probably the first time that the problem of carrying 12,000 amp. at 1,000 cycles or more has been successfully handled. Before the furnace is tilted for pouring the electrical connections are separated. The water connections can be disconnected for about one-half hour without boiling the water out of the furnace coil.



4-ton coreless induction furnace in Chicago district

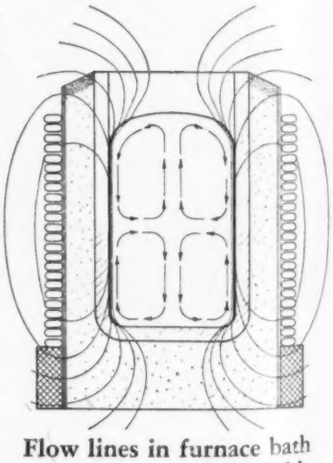


Schematic representation of principal components of coreless furnace



Section through 4-ton coreless furnace

The hearth and coil are supported on structural steel beams. Any molten metal which may accidentally leak will fall into the pit, thus reducing the danger of serious injury to the furnace casing. The latter is made of structural steel shielded inside with sheet copper. "Almag," a mixture of magnesia and alumina, is used for the refractory.



Flow lines in furnace bath caused by magnetic fields

The switchboard controls the cooling water, voltage on the generator line, taps on the furnace coil and condenser bank, and will warn of overheating of the motor-generator supplying the furnace.

Up to the receipt of this information the furnace had melted USS 18-8 (18 per cent chromium, 8 per cent nickel), USS 17 (17 per cent chromium), USS 21 (21 per cent chromium), USS 12 (12 per cent chromium), 4 to 6 per cent chromium steel (0.15 carbon), plain carbon tool steel, 2.5 per cent chrominum steel (1.5 per cent carbon), and SAE 41-30 steel. There has been no time to check the metallurgical results conclusively, but it can be said that the USS 18-8 produced from scrap is equal to the arc-furnace product, says Dudley Willcox, treasurer and assistant general manager of the Ajax Electrothermic Corporation, who furnished the foregoing information.

▼

Capacitance Transformers for Ground Directional Relays

By FRED B. DOOLITTLE

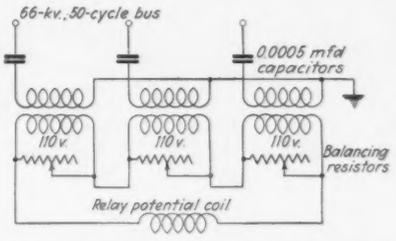
Radio Engineer Southern California Edison Company, Ltd.

Three capacitance transformers were installed on the 66-kv. bus at one of the Southern California Edison stations about two years ago primarily to supply residual voltage for the operation of ground directional relays which were desired for more sensitive relaying of the lines at this location. Three transformers were employed in order that potential might be available for phase-directional relays at a later date.

With the optimum adjustment of the balancing resistors a minimum of 16 volts was obtained across the potential coils of the residual directional relays, the voltage across each transformer being nominally 110 volts under no-fault conditions. It was assumed that this residual voltage was due to difference in power factor of the capacitance transformers and might cause incorrect relay operation. Therefore the relays were connected to operate a bell and an annunciator, but not to trip any circuit breakers, the object being to gain some experience from records of relay operations under actual fault conditions.

Recently capacitance transformers were proposed in connection with the relaying of some very important circuits and their use was questioned on the basis of the experience just described, only one actual fault, which operated the experimental relay set-up correctly, having occurred in the time that this installation had been in service. Consequently further investigation of the existing set-up was made, after verifying the previous results, by connecting a $\frac{1}{4}$-mfd. condenser in series with a 10,000-ohm voltmeter of the copper-oxide type across the potential coil of the residual relay. The meter read 14.3 volts. From this reading and the previous reading of 16 volts across the relay coil the voltage drop across the $\frac{1}{4}$-mfd. condenser was found to be 7.2 volts. The reactance of the condenser, X_c, was then obtained from the proportionality $X_c/7.2 = 10{,}000/14.3$ or $X_c = 5{,}030$ ohms.

Since this reactance of the condenser was much closer to its theoretical reactance at 150 cycles (12,700 ohms) than at 50 cycles (4,175 ohms), it was concluded that the residual voltage was principally third harmonic. Third harmonic voltage applied to the potential coil of the directional relay with fundamental current in the current coil produces no resultant torque, so that the existing set-up would probably operate satisfactorily, responding only to fundamental currents and voltages.



Residual voltage is obtained by closing the delta-connected secondary of the transformers through the relay potential coil circuit. The adjustable resistors connected across each transformer secondary balance the secondary voltages by loading the transformers.

Residual voltage for ground directional relays provided by capacitance transformers

Because the magnitude of the third harmonic voltage in the residual circuit formed by the delta-connected transformer secondaries was so large, being in the order of 17 per cent, it was assumed that it must be principally harmonic generation in the transformers themselves. This assumption was verified by star connecting the three capacitors and connecting the neutral point thus formed to ground through one of the transformers. With this connection, 0.9 volt residual was read across the secondary of this transformer as compared with the 16 volts with the former connection.

Rural Service Needs Selling

Electricity has made a formidable entry into the rural field, but it has been only a beginning. The number of farms electrified from high lines will be increased and multiplied as rapidly as power companies are able to extend their lines into the country and commodity prices enable the farmer to have the necessities for economical production. I know of no more fruitful field of development for you.

Of course, the extent to which you can project your lines into the country depends a good deal upon the extent to which farmers use "juice" after it is made available to them. That is the job of selling, and to the extent that you do it well, the cost for furnishing rural service will be so reduced that it will cease to be the troublesome problem it has been in the past. Place your salesmen and advertising on a basis of equal or greater importance with your engineers as a means of reducing kilowatt-hour costs and you will be surprised at the results. Heretofore this has not been done.

S. R. McKELVIE

Ex-Governor of Nebraska, to Middle West N.E.L.A. convention.

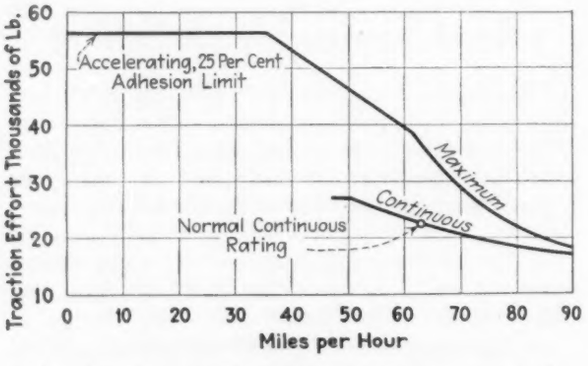
Three New Classes of Locomotives

Built on unit principle with flexible motive power, interchangeable parts, improved accessibility and sustained available output

DEVELOPMENT of the new electric locomotives for the Pennsylvania Railroad is particularly interesting because it illustrates how starting with fundamentals instead of merely modifying existing equipment can simplify the locomotives for heavy and light duty passenger or freight service. By taking advantage of advances in single-phase motor design it has been possible to develop simpler, lighter and cheaper locomotives. Driving units have been developed which, in different combinations, can be used for any class of service. Application of the unit idea to locomotive design has made it possible to build and assemble the chassis, deck and cab equipment separately. Interchangeability of electric equipment has been made practically complete; many elements of the mechanical structure are also interchangeable. Accessibility for inspection and repair has been grealty increased. The designs developed have greater hauling capacity than the Atlantic, Pacific and Mikado steam locomotives now used by the company for corresponding service.

J. V. B. Duer, electrical engineer of the Pennsylvania Railroad, discussed how these and other objectives were accomplished while talking recently before the A.I.E.E. transportation group.

Design of the heavy-duty electric passenger locomotives (P5) was preceded by decisions on several important questions: After a review of its steam locomotive practice it was decided to work to a maximum weight per pair of drivers of 75,000 lb. and a total weight of 375,000 lb. Consideration was given to the mechanical structure of electric locomotives, the speed at which they would operate and the physical characteristics of the route over which they would be used. Single-phase motors were selected. In this selection and that of other electrical equipment consideration was given to the best method of taking full advantage of the permissible weight on drivers. In determining the horsepower and tractive effort necessary, it was felt that if the general characteristics of its through-passenger steam locomotives could be duplicated or bettered the electric locomotives would provide a very satisfactory unit for this service.



Accelerating tractive effort is 250 per cent of 60-mile continuous rating

Heavy-duty passenger locomotive, type P5

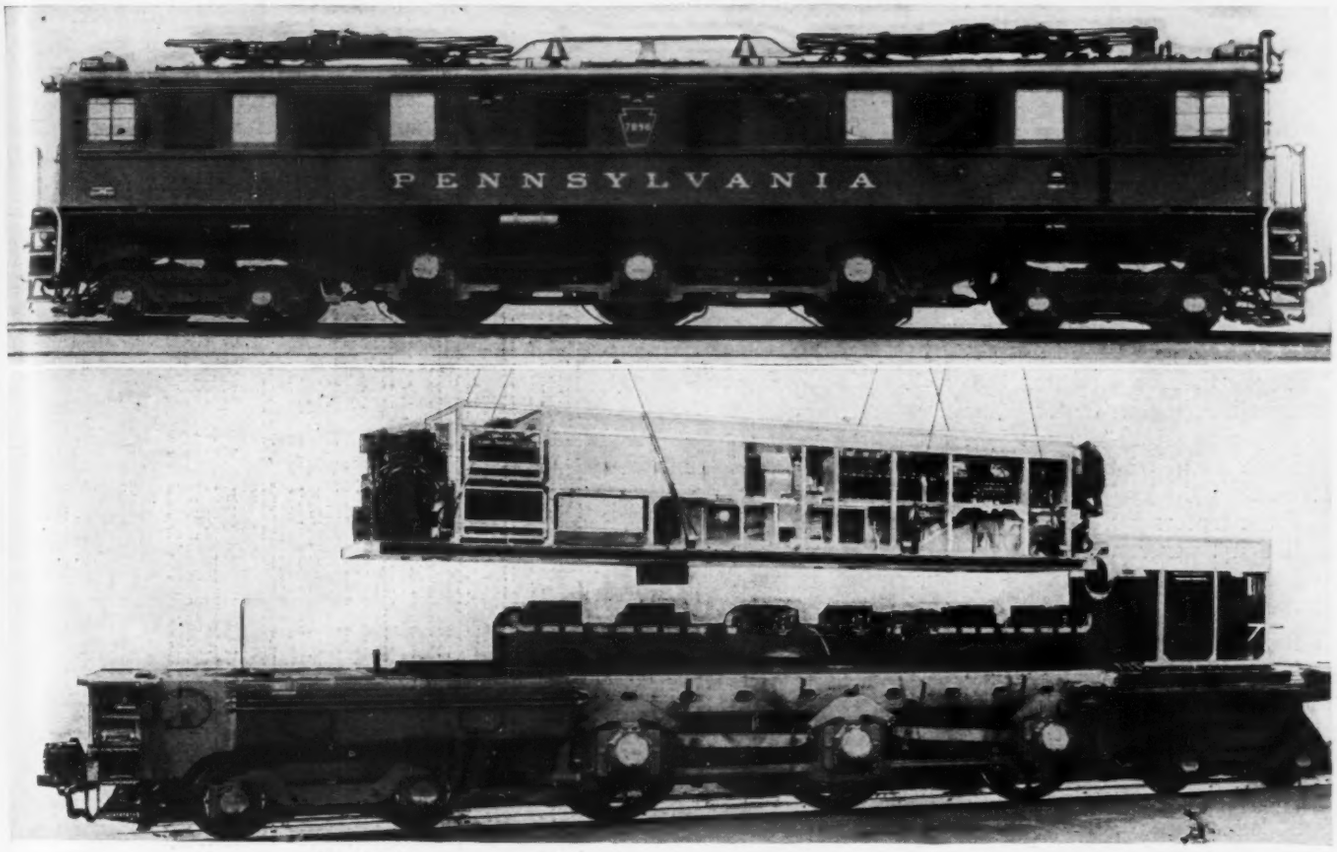
Ninety miles an hour was selected as the maximum operating speed to provide adequate tolerance over present operating speeds and permit increasing operating speeds if desirable in the future. Previous experience with electric locomotives indicated that there should be no trouble in obtaining an adhesion factor of 25 per cent of the weight on drivers under almost any normal operating conditions.

Simplified—Developments in single-phase motors now permit the installation between the driving wheels of sufficient motor capacity effectively to handle the maximum tractive effort per pair of drivers. Hence jackshafts and side rods are no longer necessary. Among the developments which made possible the increase in motor capacity may be mentioned an increase in permissible peripheral speed of both armature conductors and commutator. This increase resulted from improvements in the mechanical design of both armature and commutator, the use of roller bearings for the armature and improved mechanical design of gears and pinions. Another development which contributed is the increase in efficiency by forced motor ventilation.

The sustained available and controllable continuous output of the P5 locomotive over wide ranges of speed and with varying line regulation, made possible by the use of this motor and a transformer with suitably selected taps, is an outstanding characteristic of this locomotive.

With the driving unit selected as a basis, it is possible to design locomotives for freight and passenger service by using a suitable multiple of driving units in combination with idle truck units. Thus in the P5 type a motor unit consisting of two armatures and stators in a single frame was selected as the motive power for a pair of drivers, the wheels being propelled through an adaptation of the well-known quill drive. In the light-duty passenger locomotive (O1) identical units are used with a lesser number of drivers. In the freight locomotive (L6) single motors are mounted in a frame for axle mounting and the wheels driven by the conventional gear reduction.

As the design of the P5 locomotive progressed it was found that three pairs of drivers mounted in a single frame with each pair equipped with the motor unit described, and with a four-wheel truck at either end of the locomotive, provided a locomotive having somewhat greater capacity than the present through-passenger



Heavy-duty passenger locomotive showing apparatus deck being lowered on assembled chassis

locomotives of the Pacific type. An assembly of two sets of twin motors with two pairs of drivers and a four-wheel truck at either end provided a locomotive (O1) of somewhat greater capacity than the through-passenger locomotives of the Atlantic type. An assembly of four pairs of drivers and a single armature driving each pair through gears and pinions, with a two-wheel truck at either end of the locomotive (L6), provided somewhat greater capacity than the Mikado freight locomotives.

Flexibility—Great flexibility of motive power is permitted by these designs. With an O1 locomotive 2,500 hp. is available with two pairs of drivers, with the P5 locomotive 3,750 hp. is available with three pairs of drivers, with two O1 locomotives 5,000 hp. is available with four pairs of drivers, with an O1 and a P5 locomotive 6,250 hp. is available and with two P5 locomotives 7,500 hp. is available.

Thus it is possible to increase locomotive capacity in steps of one pair of drivers, or 1,250 hp., and a unit can be selected for almost any weight or size of passenger train now used on the railroad or likely to be used in the near future. While the freight locomotive's capacity cannot be increased in such steps, a careful study of freight service indicated that the unit selected is the best all-around unit for handling Pennsylvania freight trains and that the steps in which the capacity can be increased are sufficiently flexible.

Experience with construction and maintenance has indicated, declared Mr. Duer, that in any class of electric locomotive any part should be readily removable and replaceable, and that, in so far as possible, all parts should be interchangeable between individual locomotives of the same class. The desirability of still further applying this principle to different classes of electric locomotives is evident.

With the co-operation of the electrical manufacturing companies this has been accomplished in the P5 locomotive. Any unit or part, such as an armature, motor, brush-holder, transformer or control unit, will fit into and perform properly in any locomotive assembly, regardless of the manufacture of other parts in that assembly.

Unit Assemblies—This principle has been further developed in the locomotive assemblies by designing each locomotive in three units: Chassis, deck and cab. The chassis consists of the drivers, trucks, main frame, spring and brake rigging, motor, flexible drives, main transformer and train-heating boiler, with the necessary water and oil storage reservoirs and air, oil and water piping. The deck unit carries the main control groups, air compressor, main wiring and most of the control wiring. The cab unit forms a weatherproof housing for the locomotive crew and apparatus.

Each of these three units of a locomotive may be assembled independently of the other units and the completed units may then be assembled into a complete locomotive. Parts, such as a pair of drivers with the drive and motors, a truck, a control unit, etc., may be removed and replaced with a minimum of disturbance to the rest of the locomotive.

The light-duty passenger locomotive (O1) is in all respects similar to the preceding except that it has two driving axles instead of three, and is consequently of

smaller capacity. The equipment in the two locomotives is similar in every respect except that the transformer is of the smaller capacity necessary for the smaller motor capacity.

The freight locomotive (L6) has four driving units, each of which has but one motor armature with its frame. However, the single motors of the L6 locomotives are identical with the single motors of the "twins" used in the passenger locomotives except for the frame, end housings and pinion-end bearings. In the L6 locomotive the cab and apparatus deck is of steel, because weight restrictions do not make the use of aluminum necessary as in the P5 and O1 locomotives.

It may thus be seen that the P5 has six-motor armatures, the O1 four-motor armatures and the L6 four-motor armatures. These motor armatures are all alike and the twin frames are all alike, as are the single frames.

These motors have been nominally rated continuously at 625 hp. per armature at the locomotive driver rims and this gives a nominal continuous rating of the three classes of locomotives as follows:

	Class	Brake Hp.	Miles per Hour	Tractive Effort (Lb.)
Heavy-duty passenger....	P5	3,750	63.0	22,300
Light-duty passenger.....	01	2,500	63.0	14,900
Freight.....	L6	2,500	37.8	24,800

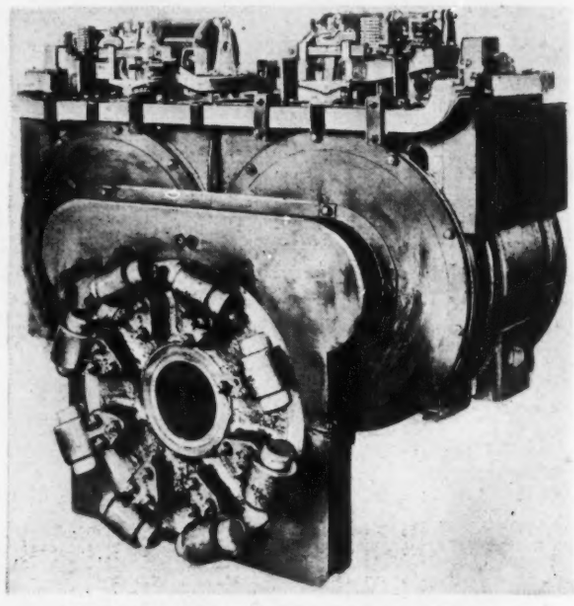
The rating of the L6 locomotive applies when equipped with a gear ratio for 54 m.p.h. maximum speed; that of the P5 and O1 locomotives when geared for a maximum speed of 90 m.p.h.

Interchangeability — Interchangeability of electrical parts is practically complete on the three classes of locomotives. The unit switches, master controllers, air compressors and motors, pantographs, motor-driven blowers for motor ventilation and relay systems are identical. The preventive coils and transformers are identical on the O1 and L6 locomotives, but are larger on the P5 locomotive because of the greater capacity required.

Although the assembled motors on the O1 and P5 locomotives are of the twin-armature frame-supported type and those on the L6 locomotives are of the conventional single-armature axle-supported type, the individual parts of the motors, including armatures and stators, are identical except that a larger pinion bearing is used in the axle-supported motor to take care of the higher duty required by the freight gearing. The stators may be pressed into or out of either type of frame.

The mechanical parts of the O1 and P5 locomotives are interchangeable to a large extent; the driving wheel assemblies, including the bearings, are the same; truck assemblies are the same. Many parts of the spring, equalizing and brake rigging are identical. In addition, many of the parts used to make up the apparatus deck and cab structure are the same.

Accessibility—Accessibility of apparatus for inspection and repair was the subject of continual study during the progress of the design. As a result a locomotive may have a defective piece of apparatus replaced and the locomotive returned to service in the minimum amount of time. For this purpose hatches are provided in the roof of all three classes of locomotives and so arranged that any piece of apparatus inside the cab may be readily removed. A complete driving wheel assembly, including the motors, may be dropped from the frame in the repair shop and replaced in a relatively short time. Thus all electrical parts of the locomotive are readily accessible and renewable either from above or below. In addition, each piece of apparatus inside the cab may be readily inspected at periodic intervals from the interior of the cab, and the commutators and brush-holders of the main motors may be equally readily inspected from the inspection pit.



Pinion end of twin-motor assembly for heavy-duty passenger locomotive
Note quill drive

Handling of the large quantity of ventilating air necessary for cooling the motors and transformers is facilitated by louvers in the sides of the cabs which may be opened or closed, depending on the weather conditions. They are so designed that screening devices may be applied should it be necessary.

Protective Features—For some years it has been Pennsylvania practice to omit the use of a current-rupturing device between the pantograph and the primary of the main transformer and substitute in its place a pantograph lowering relay. This is so connected as to use the substation circuit breakers to open high-tension short circuits, grounds or overloads on the locomotive. In the P5, L6 and O1 locomotives this device has been supplemented by an automatic grounding device which functions automatically under transformer short circuit or overload conditions to ground the pantograph, thus opening the substation circuit breakers, after which the pantograph is automatically lowered and locked.

Protection against motor overload in these locomotives is provided by relays permitting the maximum advantage to be taken of the tractive effort made available by driving-wheel adhesion, but at the same time affording protection for the motors should this adhesion exceed normal values because of sand or mishandling of the equipment. This relay protection is interlinked with anti-wheel-slip protection which brings driving wheel slippage to the engineman's attention if he does not otherwise detect it.

May Industry on April Level

Renewed activity in automobiles balances slack in metals and textiles

EQUALITY with the preceding month, or at most comparatively slight changes, characterized the rate of activity in various fields of manufacturing during May. Reports of electrical energy consumption, as received by the ELECTRICAL WORLD, reveal increases in some plants, but these were very nearly balanced by reductions in others of the same group. Similarly, such slight changes as remained in the several groups balanced out in the general average, leaving only a rise of about 1 per cent when the index for May is conpared with the revised index for April.

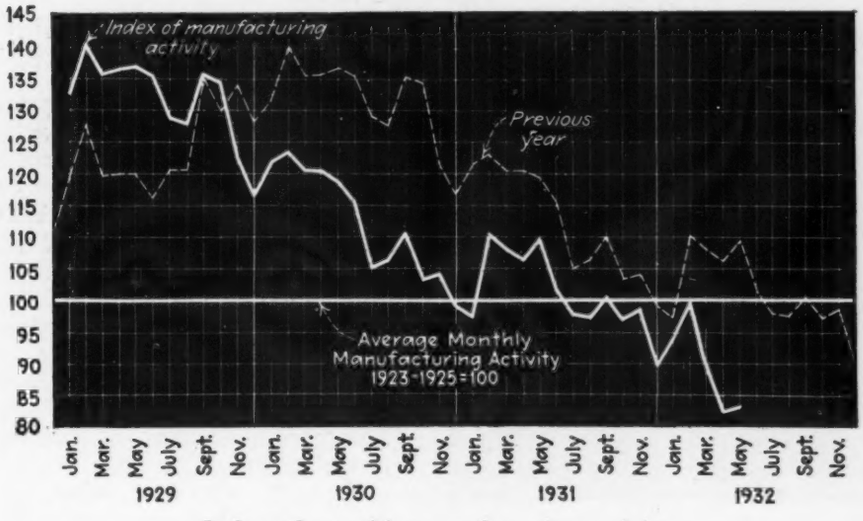
Successive declines have brought the present level 24 per cent below that prevailing a year ago, and 40 per cent below the peak in the early part of 1929.

The most noteworthy change occurred in the automobile industry. For a number of months the trend had been downward, but May registered a 10 per cent increase over April. The change clearly reflects the reported expansion of work in the Detroit area, which, however, affected only a part of the industry. In some plants a slackening is indicated.

Because of its relation to the construction industry the sustained improvement in the stone, clay and glass group during the two spring months deserves attention.

In contrast, the metal industries remain on an extremely low plane, down another 40 per cent since May, 1931, after a previous drastic recession. Lately the decrease has been particularly noticeable in New England.

Of the "consumer group" the food industries continue almost uninfluenced by changes elsewhere; leather products and particularly textiles are much lower than they were a few months ago. This applies especially to New England, where the textile index has for the past two months been lower than at any other time since the compilation of this series of indices was begun. North Central metal working rose moderately.

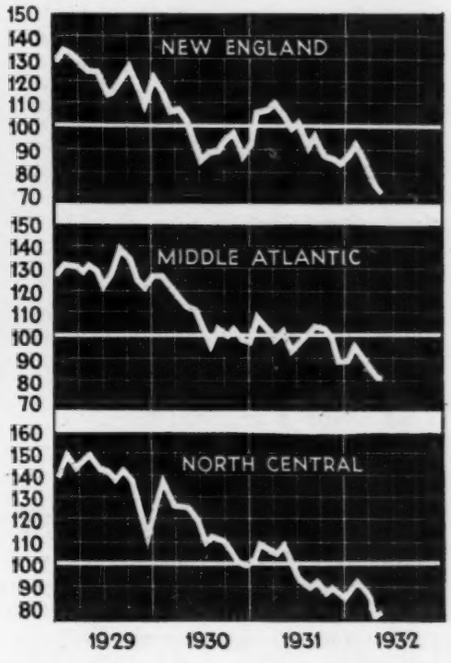


Index of monthly manufacturing activity

Base: Average month 1923-1925 = 100.

(Corrected for number of working days, but not for seasonal variation.)

These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries and scattered throughout the country.



Industrial Group	United States May, 1932	United States April, 1932	United States March, 1932	United States May, 1931	New England May, 1932	New England April, 1932	New England March, 1932	New England May, 1931	Middle Atlantic May, 1932	Middle Atlantic April 1932	Middle Atlantic March, 1932	Middle Atlantic May, 1931	North Central May, 1932	North Central April, 1932	North Central March, 1932	North Central May, 1931
All Industry	83.0	82.2*	88.0	109.8	71.1	73.2*	83.9	104.4	77.3	80.7*	84.2	101.3	79.7	77.2*	82.4	109.2
Automobile (including parts and accessories)	71.2	64.4	72.8	89.7	.....	.....	.....	.....	66.2	61.7*	68.1	97.2	70.6	64.3	73.6	93.2
Chemical products (including oil refining)	125.2	118.9*	125.1	133.8	148.3	152.9*	134.4	163.3	136.0	131.9*	142.0	145.2	119.2	112.3*	105.5	155.4
Food products	120.4	116.7*	114.9	126.8	.....	.....	.....	.....	91.7	85.3	86.4	96.9	106.3	106.6*	100.7	127.3
Iron and steel	63.7	64.9	66.4	106.6	79.1	91.4	99.2	134.0	52.5	58.3	61.1	94.3	66.6	65.4	69.7	107.5
Metal working	56.3	57.2*	64.8	94.0	71.1	71.8	83.0	104.1	53.4	64.4	65.0	83.0	54.2	51.2*	60.9	87.7
Leather products	75.6	75.6*	86.7	81.0	59.2	67.0	70.8	77.0	84.3	83.1*	104.8	85.0	64.7	74.1*	75.2	80.0
Forest products	70.4	76.0	78.2	97.2	41.6	40.1	46.3	50.3	63.2	59.5*	42.6	80.1	79.3	87.5*	98.4	102.7
Paper and pulp	105.8	105.5	114.4	135.1	109.0	108.0	117.7	145.6	65.0	71.0*	72.3	76.4	86.8	79.5*	88.1	111.6
Rubber products	90.5	88.3	96.8	122.3	89.8	86.0*	84.0	87.0	.....	.....	.....	.....	97.2	93.4	105.7	140.5
Shipbuilding	87.8	91.1	84.5	89.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Stone, clay and glass	97.3	96.4*	81.9	132.0	.....	.....	.....	.....	83.4	81.3*	63.9	123.5	95.5	84.2*	88.6	143.2
Textiles	65.2	69.2	86.0	103.7	48.0	48.4*	71.3	89.1	78.8	87.8*	95.5	113.8	91.2	98.4*	110.9	103.5

*Revision.

Doherty Tower Floodlighted

New Cities Service building rises 950 ft. above ground in New York.

Attractive floodlighting symbolizes power and adds to night effect.

By

ALFRED PAULUS

Westinghouse Lamp Company

and

A. SIRA

Clinton & Russell, Architects

RISING 950 ft. above street level, the new Sixty Wall Tower, constructed for Cities Service and Henry L. Doherty interests, is now the highest skyscraper on lower Manhattan and the third largest office building in the world.

As the property of a utility, it naturally should symbolize the present-day function of electric power. On the exterior floodlighting creates that symbol. As a tool of the architect, it is more than just an advertising medium. Light and shadow lend a distinctive emphasis to the features of the design. They enhance the beauty and character of the façade to a degree rivaling that of daytime admiration.

The original plan for floodlighting this building specified that the illumination be graduated from a moderate intensity at the lowest point of application (59th floor) to a high intensity at the pinnacle. That effect is achieved largely by the physical layout of the installation. The amount of illumination per square foot of building surface increases gradually at higher levels. A huge, glass-inclosed lantern surmounting the tower forms the crowning feature of the illumination design.

The method of mounting floodlight projectors for this installation perhaps commands first interest of those in the industry.

A single 2-in. pipe conduit, attached by brackets at the base of the iron grill railings on each balcony setback, supports the projectors about a foot above the floor. Thus they are up off the floor and out of the way of cleaners and above the snow line. Considerable importance was placed on mounting the projectors out of the way of office workers who use the balconies, particularly on the 64th floor setback, which is a continuous balcony around the entire tower, serving as a promenade for the board of directors' room.

The projectors are clamped to the pipe on uniform spacings. They are supplied with current from feeders inside the conduit. This arrangement protects the feeder wire from the weather and at the same time eliminates the need of outlet boxes. The splice of feeder and projector lead wire has been drawn into the pipe through an opening underneath and closed with a packing nut as an added precaution against moisture.

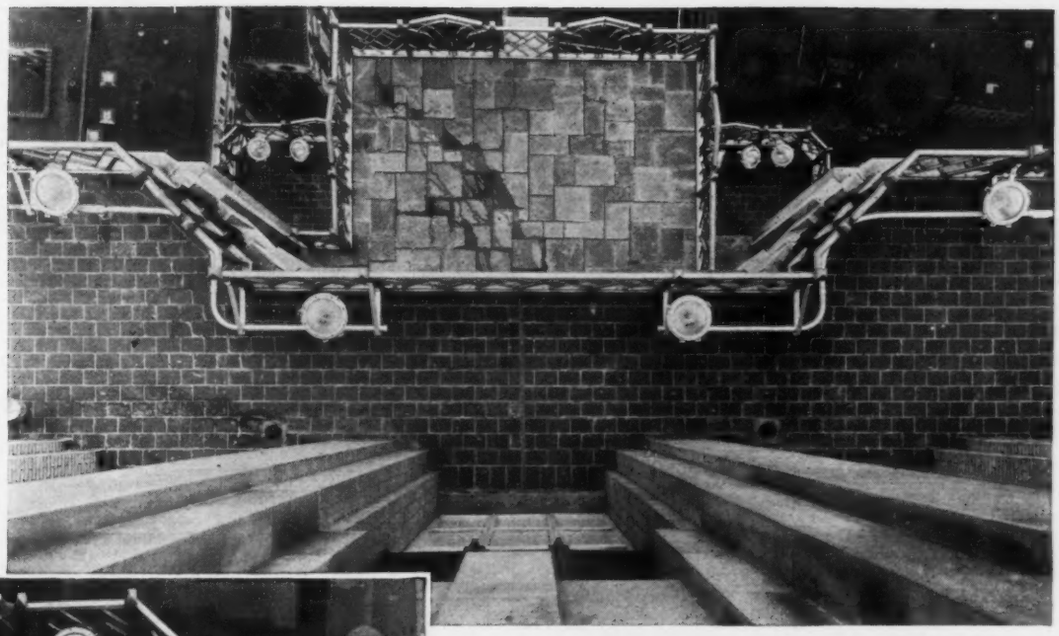
One story of the tower façade, beginning at the 63d floor and ending at the 64th, is illuminated in a unique fashion. It was impractical to project light there without special provisions. Cornice projectors, each equipped with two 150-watt lamps, have been mounted on the window sill on each face, throwing just enough light upward to boost the illumination there to design requirements.

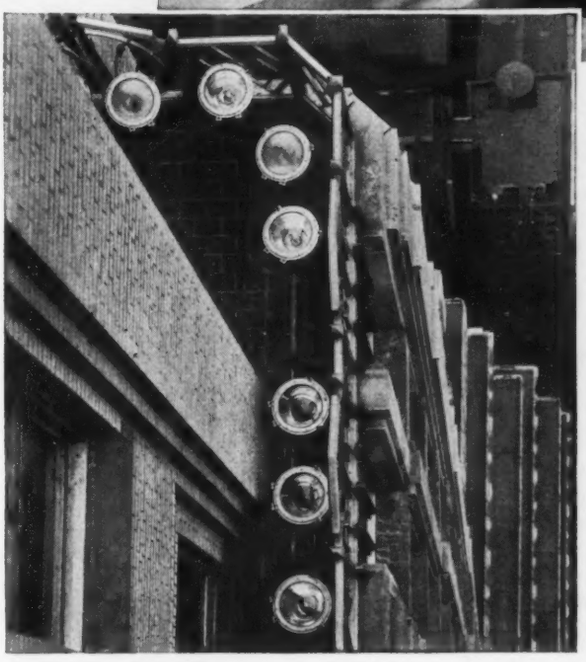
Some of the problems of light throw occurring on the Sixty Wall Tower are a bit out of the ordinary in architectural lighting.

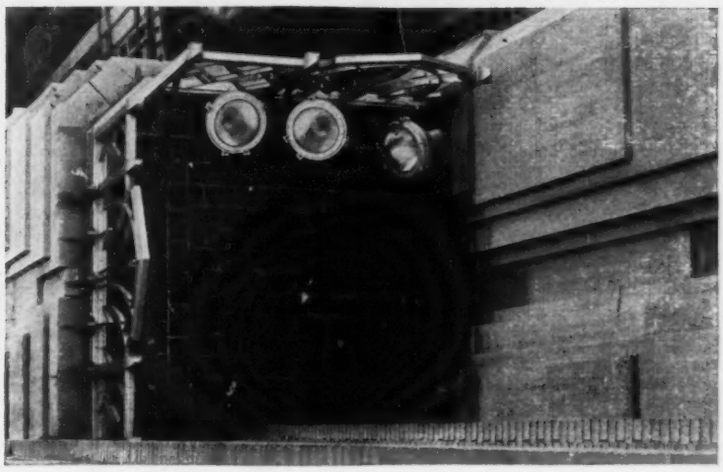
From the 59th floor, where the illumination of the tower begins, light is projected up a protruding pilaster to the 64th floor. At the base of this façade the setback is so narrow that only 10-in. projectors could be used. The remainder of the installation uses 14-in. units. The narrow mounting area resulted in a light throw almost vertical, requiring narrow beam projection. To get the narrow beams it was necessary to use 250-watt, G-30 bulb lamps, and clear lenses in the projectors.

As a result of the grazing angle of these light beams the illumination at the top of the throw faded out to below design intensity at that point. To correct this condition auxiliary light has been projected from setbacks at the 62d floor. One of the projectors, located on each one of these balconies, is set to illuminate the pilaster for two stories.

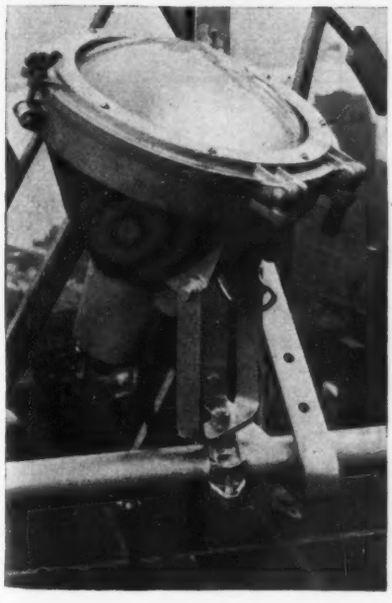
Another unusual requirement of light projection occurred on the 62d floor setbacks. Each side of the tower at this level has two small balcony setbacks, one on either side of a protruding section which ends in the balcony at the 63d floor. Only one of the two façades







Photos courtesy Westinghouse



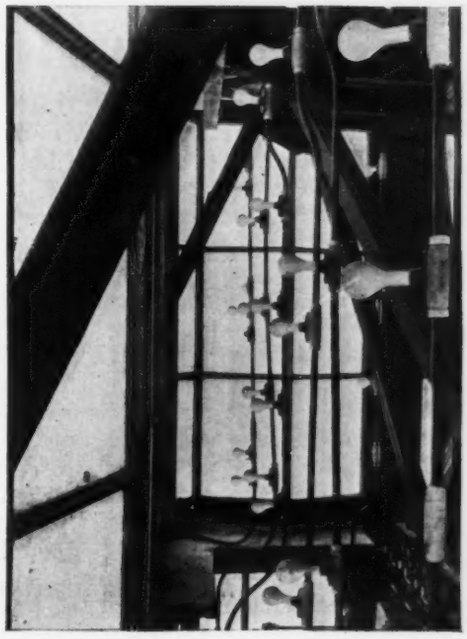
Top—Looking down on the 62d and 64th floor setbacks shows the floodlight units on the north façade.

Right, center — Three floodlights on 62d floor creating light and shade effect on adjacent façades.

Left, center—The setback on 59th floor is so narrow that façade illumination is almost vertical.

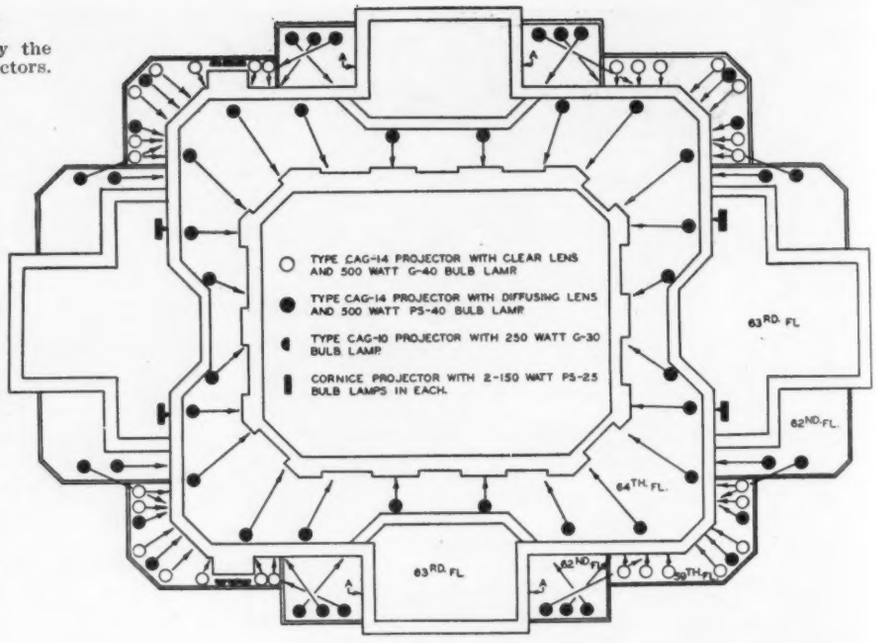
Below, right—Interior of lantern which runs 20 ft. above 67th floor. 200 lamps with 15 watts per square foot of glass area.

Below, left — Floodlighting units are mounted on 2-in. pipe which runs around the edge of the setbacks. Feeders are inside the pipe.



Layout of Sixty Wall floodlighting

Walls marked A are purposely kept dark by the use of visors and spill rings on nearby projectors.


TYPE CAG-14 PROJECTOR WITH CLEAR LENS AND 500 WATT G-40 BULB LAMP
TYPE CAG-14 PROJECTOR WITH DIFFUSING LENS AND 500 WATT PS-40 BULB LAMP
TYPE CAG-10 PROJECTOR WITH 250 WATT G-30 BULB LAMP
CORNICE PROJECTOR WITH 2-150 WATT PS-25 BULB LAMPS IN EACH
63RD. FL.
62ND. FL.
64TH. FL.
63RD. FL.
62ND. FL.
59TH. FL.

forming the corner of these setbacks was to be illuminated; the other was to receive no light whatsoever, excepting what might reach it by reflection from the lighted area.

To create this definite effect of light and shadow the projectors at that level were equipped with aluminum visors and louvers so that no spill light would fall on the dark façade. This peculiar arrangement makes the corners of the tower from the 59th to the 64th floors appear self-luminous, producing an interesting contrast in the light and shadow effect.

As the crowning point of the tower, a huge illuminated lantern produces a high intensity that appropriately completes the lighting design.

It rises 20 ft. above the 67th floor and is surmounted with a neon tube beacon. There are 1,300 sq.ft. of glass surface, formed of two sheets in panels approximately 2 ft. square. The outside sheet is wired glass and the inside sheet is flashed opal. The wired glass is required to conform with the building code, since the lantern is classed as a skylight. Each sheet of glass is $\frac{1}{4}$ in. thick.

Illumination for the lantern is produced by 200 "Mazda" lamps of 100 and 150 watts. Each lamp is mounted on vertical pipe conduit, about 2 ft. from the glass. No reflectors are used, since it would not increase the efficiency of the lighting, for the light of each lamp aids in building up illumination on all sides of the lantern. The network of structural steel which supports the mast inside the lantern made it practically impossible to use a few large sources of light. Fuse boxes for the lighting are located inside the lantern.

The load of 25 kw. required for the lantern illumination creates so much heat that ventilation was provided. Grillwork panels at the bottom and top of the lantern permit a constant natural circulation of air.

Beacon lights

The large neon beacon just above the lantern consists of 24 long tubes, operated on the hot cathode principle. Close at hand it appears a deep red, but viewed from a distance, such as the shores of Jersey and Long Island, it blends with the light of the lantern to produce an orange hue, and seems to be a plume on top.

At the very top of the mast is another beacon formed by a single tube. Of course, the larger beacon at the base of the mast clearly marks the building top for night fliers, but the tiny beacon atop the mast lends added safety to the pilot who might be forced to a dangerously low altitude because of a low ceiling.

A unique method of raising this tiny beacon to the mast top deserves mention. The mast itself is hollow and acts as an elevator shaft, in which a tiny car operates. A single-tube beacon is mounted on this elevator and hoisted to the tip. It is much like a dumbwaiter in an apartment building. When the tiny car reaches the top of the mast it slides into a fixed position formed by a waterproof ring. Inside the illuminated lantern below is the "main floor" of the miniature elevator shaft, where beacon tubes may be replaced conveniently.

A total of 90 Westinghouse floodlight projectors are used in the illumination of Sixty Wall Tower. Except for the 10-in. units necessary in the narrow mounting space on the 59th floor and the four cornice units located on the 63d floor, all are CAG-14 floodlight projectors. Most of those on the 59th floor level are equipped with clear lenses and G-30 and G-40 floodlight lamps. All others were equipped with diffusing lenses and PS-40 lamps.

To obtain high lighting efficiency and to minimize spill light each projector has a three-surface mirrored glass reflector. Cast aluminum projectors harmonize with the aluminum paint on the grilled iron balustrade which borders each balcony setback and resists the atmospheric acids.

In viewing the new Sixty Wall Tower by day and by night the observer sees two different types of beauty, each deserving of his admiration. Architectural lighting on this building has been splendidly created through the medium of light and shadow to emphasize certain features that give the tower an individual night-time design.

While They Last

Publication of the supplement to the ELECTRICAL WORLD of May 2, giving detailed data on operations during 1931 of 172 large public utility systems, has brought requests for similar data for 1930. This information was contained in the supplement of May 3, 1931.

Readers desiring copies of the latter may obtain them, until the supply is exhausted, by addressing the Statistical Editor.

Where Continuous Service Is Imperative

By A. L. O'BANION

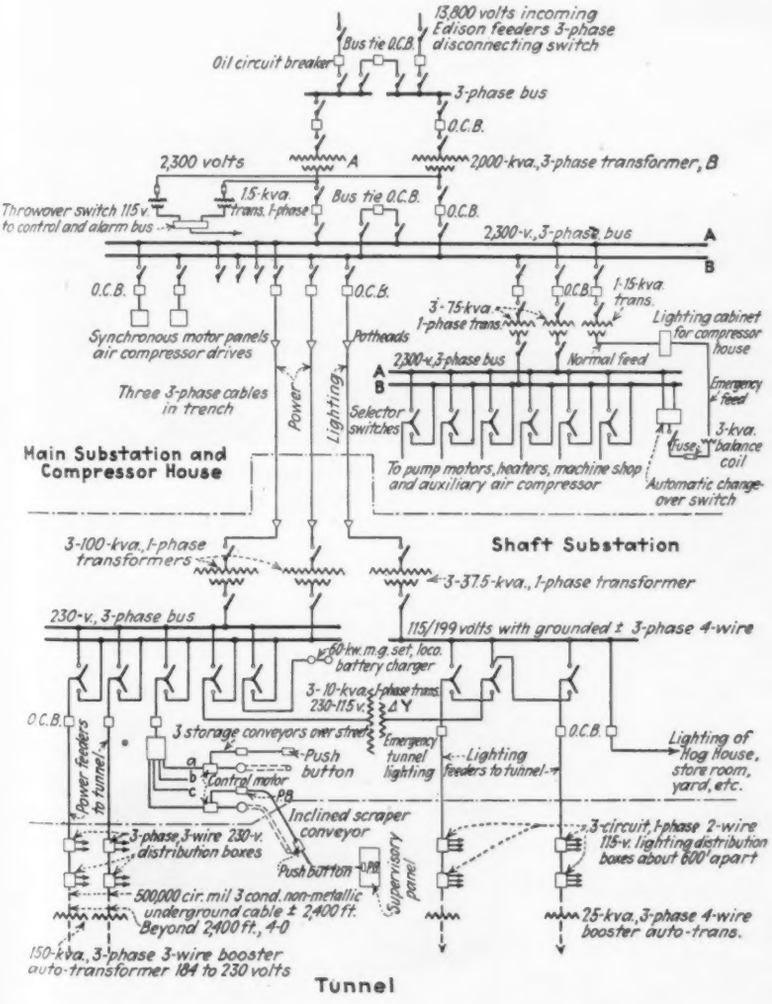
Marine tunnel construction imposes severe electrical responsibilities. Flexible distribution system aids contractors on difficult job. Improved methods adopted.

ON MOST construction jobs minimum first cost of field equipment with capacity to handle the work is a controlling consideration, but in submarine tunnel building, where air pressure must be maintained to safeguard human life, continuity of service is of major importance. In the Boston traffic tunnel now under construction electricity is literally the "key tool" of the job. About 2,400 hp. in motors and 115 kw. in lighting are in use.

The tunnel is being built under Boston Harbor between East Boston and the city's business district, being about 5,400 ft. between portals. About 4,800 ft. is excavated by the shield method. The shield is driven forward by hydraulic jacks served by motor-driven hydraulic pumps on the ground surface; all dirt or "muck" is handled by motor-driven conveyors running through air locks and delivering material to shaft-hoisting equipment which brings it to the surface, and the compressed air supply, lighting and auxiliary applications embody much important equipment.

Energy is supplied by the Edison Electric Illuminating Company of Boston to a combined compressor house and substation by two 13,800-volt lines normally paralleled through a bus tie circuit breaker. The high-tension breakers are mounted in cells, each section being separated from the bus tie section by an 8-in. concrete-block wall with a double-swing fire door, so that if trouble should develop in either section it would not affect the bus tie and the other section. The high-tension breakers are all Condit F-114's, with manually closing and power trips. A 36-volt storage battery provides energy for tripping these and lower voltage breakers installed on 2,300-volt feeders to the air compressor motors and transformer banks serving the job.

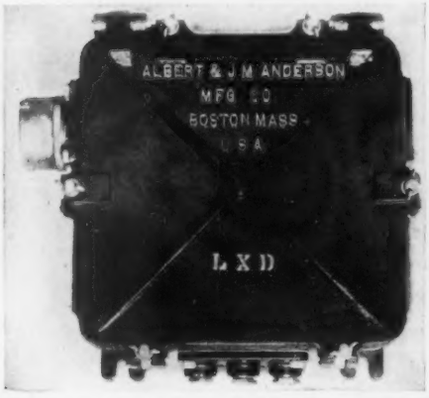
Each 13,800-volt line is connected to a 2,000-kva., three-phase transformer which delivers 2,300-volt energy to one of two sets of buses mounted on a main switchboard in the compressor house. These two sets of buses are independent except in case of failure of the supply from one transformer. In case either 2,300-volt breaker opens a bus tie breaker closes automatically and picks up the dead bus. Each transformer can handle the entire load continuously. After the trouble has been cleared the bus tie breaker must be tripped before the main 2,300-volt breaker can be closed. Only undervoltage protection is necessary, since the primary breakers will open for overload. Because of the short use of the installation approximately eighteen months) single-conductor, double-braided, rubber-covered cables are



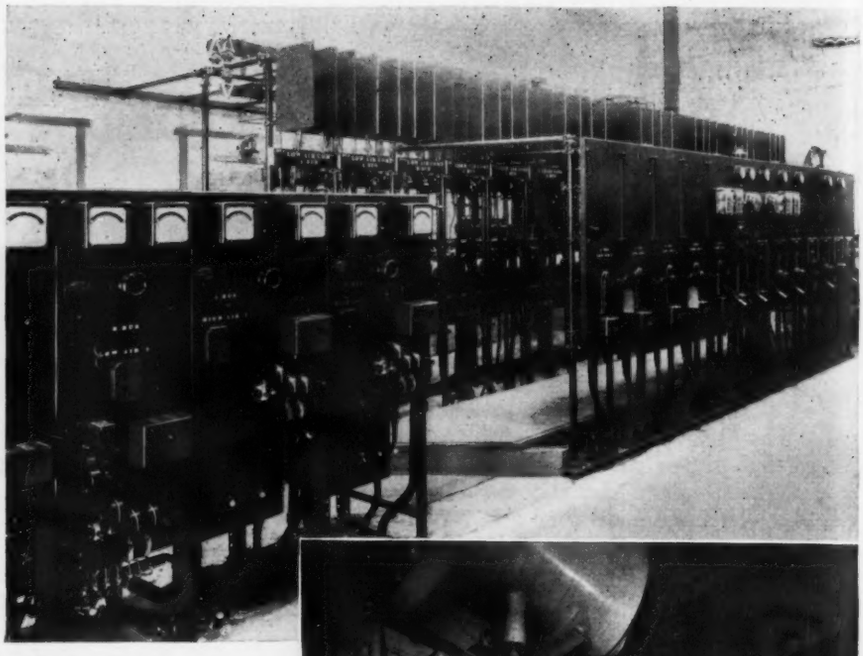
Scheme of service to tunnel provides for duplicating power and lighting facilities through double feeds and buses, extra transformer capacity and selector switching

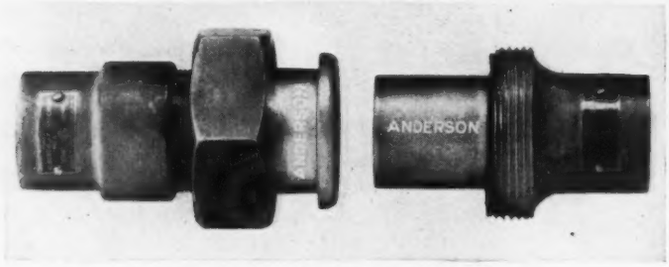
Control switchboards in compressor house reveal high standard set for construction job

Synchronous motor panels at left and 2,300-volt manually remote-controlled board at right.

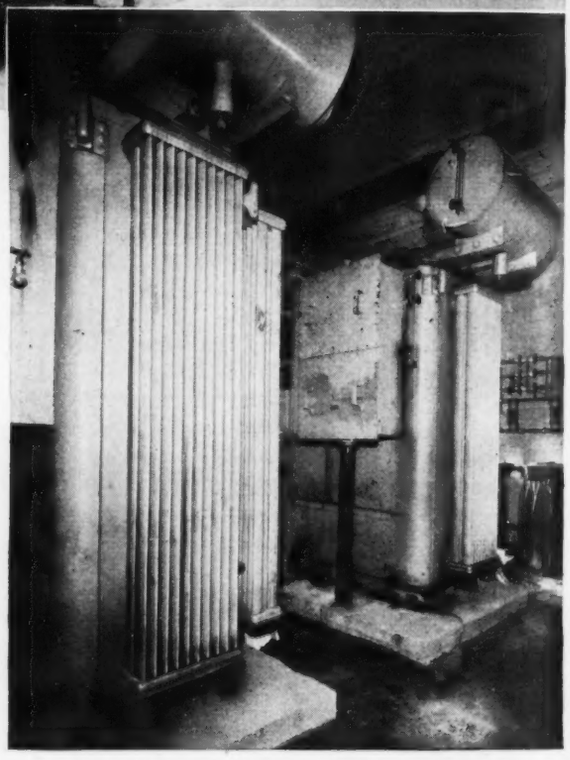


Watertight lighting distribution box used in tunnel



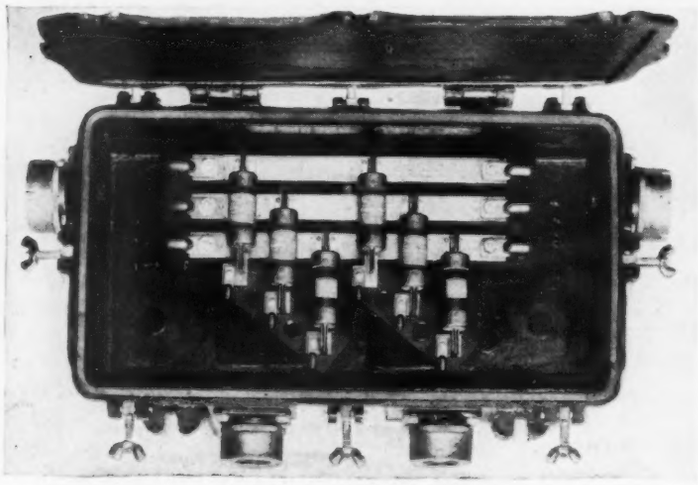


Waterproof plug and receptacle used to serve shield-lighting fixtures



2,000-kva. main transformers for total supply to job

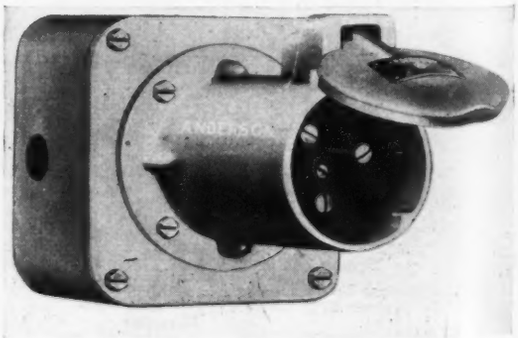
By using potheads and junction boxes on sides of transformers, with underground connections, the height of the building was kept down.

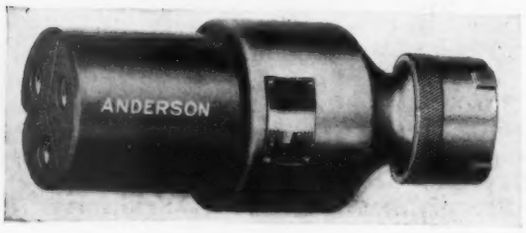


Waterproof distribution box used with power feeders in tunnel

Motor fuses are housed in these boxes.

Receptacle used in connection with plug shown at left





Three-phase, 200-amp. plug used to feed energy to slicer motors within shield

Either of two feeds can readily be disconnected to avoid interference with the erector arm of the shield when working on harbor bottom.

employed for the lower voltage circuits (2,300 and 230).

In the event of a sudden drop in tunnel air pressure a Benjamin howler alarm is sounded automatically. For driving the compressors 2,200-volt synchronous motors with belted exciters are used, the motors being provided with across-the-line, full automatic starting panels, magnetic air unloaders and with push buttons at both panel and machine to speed up starting and stopping.

Centrifugal pumps draw salt water from the harbor and circulate it through the compressors for cooling. One pump is held in reserve. To guard against failure of both pumps or loss of suction, city water can be used. A pressure switch on the discharge line gives a bell alarm in case of circulating water failure.

The hydraulic pumps for shield propulsion, water pumps and miscellaneous machine shop motor drives are supplied with 230-volt, three-phase energy by two banks of three 75-kva. transformers connected delta-delta. Each bank is capable of carrying the entire load. Between the different machines and the bus are air circuit breakers and double-throw knife switches so that any machine can be operated on either transformer bank. Further precaution against shutdown is taken by providing for disconnecting any single transformer within a few minutes and operating the other two of the bank in open delta. Instead of a fuse a cutout with a 75-amp. disconnecting blade was placed in the primary lead of each transformer, sufficient protection being assumed by the oil breaker in the bus tap.

From the compressor house to the shaft a trench about 42 in. deep carries air and water piping and a telephone conduit. Light and power cables were placed at the bottom of the trench near one edge and covered with dirt and 2 in. of planking to protect the cables in case of street excavations. This brought the cost of laying the cable under a street adjoining the compressor house to a nominal value, whereas if conduit had been employed it would have been necessary to build at least one manhole in addition to installing the conduit and pulling the cables.

Construction Power Requirements Boston Traffic Tunnel

Machinery	No.	Motors — Hp., Each	Motors — Voltage	Motors — Type
Compressor House				
Air compressors for tunnel: (50 lb.) atmosphere, cap. 3,150 c.f.m. each	3	450	2,200	Synchronous
Air compressors for tools: (100 lb.) grouting, cap. 1,105 c.f.m. each	2	225	2,200	Synchronous
Centrifugal water pumps, cap. 350 g.p.m. each at 77 ft. total head	2	15	220	Induction squirrel cage
Hydraulic pumps, four-plunger, for shield service, 1¾ x 12 in.	2	100	220	Induction wound rotor
Auxiliary air compressor	1	5	220	Induction squirrel cage
Machine shop	..	25	220	Induction squirrel cage
Lighting service	..	15 kw.	115	
Shaft and Tunnel				
Battery charger, motor-generator set	1	90	220	Squirrel cage, line start
Muck conveyors (Jeffries)				
Inclined scraper	1	50	220	Squirrel cage, line start high torque
Main conveyor units	4	20	220	Squirrel cage, line start high torque
Conveyors through bulkheads	4	5	220	Squirrel cage, line start high torque
Apron conveyors behind shield	2	7.5	220	Squirrel cage, totally inclosed
Clay slicers on shield (Shepard)	4	8.5	220	Squirrel cage
Hoist (Shepard)	2	3	220	
Sump pumps (approximate)	..	25	220	Squirrel cage
Lighting shaft, yard, buildings, tunnel	..	100 kw.	115/199	3 phase, 4 wire
(Inclined scraper and main conveyor units also totally inclosed)				
Conveyor control, Sundh; motors, G.E. and Westinghouse; main power transformers, Wagner; others, G.E.				

Shaft substation distributes energy to tunnel

It was found more economical to transmit 2,300-volt energy from the compressor house to the head of the tunnel shaft, some 400 ft. distant, than to reduce the voltage at the compressor house for tunnel power and lighting feeders. A substation was accordingly built at the head of the shaft. Two No. 4/0, three-conductor, 2,300-volt cables, were installed for power supply and one No. 4, three-conductor cable for lighting. Simplex lead-sheathed, steel-taped underground cable was used and the cost was about 45 per cent less than had conduit and cable been used in the usual manner.

Owing to a lack of space, the shaft substation could be made only 15x18 ft., so that the three banks of transformers were mounted on the roof and inclosed by a wire fence. Each of the two power banks consists of three 100-kva., 2,300/230-volt transformers connected delta-delta. If necessary either bank can be operated open-delta and either all or part of the load can be thrown on either transformer bank.

The lighting transformer bank consists of three 37½-kva., 2,300/115-volt transformers connected delta-star, with grounded neutral on the secondary side for supplying a three-phase, four-wire lighting system.

From the substation switchboard there are two separate lighting feeders into the tunnel, each three-phase, four-wire, 115 volts to neutral. The neutral is grounded and is marked in all cables. From the switchboard single-conductor cables in conduit are run to a junction box at the bottom of the shaft. From this junction box Simplex special non-metallic type of underground cable is used for feeders throughout the tunnel. Due to the moisture conditions in the tunnel 40 per cent rubber insulation is used in this cable, with impregnated paper, burlap and duck tapes. This type of cable is much cheaper than conduit and cable and more convenient to install and to shift about during construction.

From the bottom of the shaft for about 2,400 ft. size No. 4/0, four-conductor cables were used for the lighting feeders and then size No. 2/0, four-conductor cables for the remainder of the tunnel. This size of cable was found necessary to prevent excessive voltage drop. To take care of the voltage drop in the cable and avoid the use of even larger cables a 25-kva. booster transformer with taps was planned in each feeder at about 2,400 ft.

Emergency lighting provided

In the shaft substation there is an auxiliary bank of three 10-kva., 230/115-volt transformers for emergency tunnel lighting. These transformers are connected delta-star, with grounded neutral. The primaries can be connected to either power bus by means of a double-throw knife switch. By using four single-pole instead of one four-pole, double-throw knife switches on the lighting feeder circuits to the tunnel any one phase of a lighting feeder can be cleared in case of trouble and one or all

phases of a feeder can be thrown on the emergency transformer bank. The capacity of the emergency bank of transformers is sufficient to take care of the load on one feeder or about half of the tunnel lights.

Around the face and on the platforms of the shield waterproof light fixtures were installed. Provision was made for several extension cords by using Anderson waterproof plugs with "Tirex" cord and waterproof sockets and lamp guards. From the structure back of the shield there are two two-wire feeders to the shield, one feeder on each side of the tunnel, and arranged with plugs so that either cable can be disconnected to prevent interference with the erector arm when installing the steel rings of the tunnel.

Anderson cast-iron watertight distribution boxes are connected in the main lighting feeders about every 600 ft. The cover is hinged and wing nuts make it possible to open the box quickly. A rubber gasket is used under the cover. Since all feeder cables are of the non-metallic type and distribution lines are "Tirex" cables, Anderson wedge-shape rubber bushings are used to clamp the cables and make the box moisture-proof. This type of bushing reduced the cost of the boxes considerably. With it a cable can be inserted or changed more quickly than with stuffing boxes.

For the general lighting in the tunnel Benjamin "Playarea" floodlights with 1,000-watt lights are used instead of droplights with 50-watt lamps every 15 or 20 ft. The lights are placed about every 150 ft. on opposite sides of the tunnel, with additional floodlights at the bulkheads and other places as required. A study of the conditions showed that the use of the floodlights would save about $50 in first cost for every 600 ft., besides the labor saved in not cutting the "Tirex" cord every 15 or 20 ft. for a droplight. Also, the larger lamp unit is more efficient and the lamp loss due to breakage and theft will be less.

Tunnel power lines duplicated

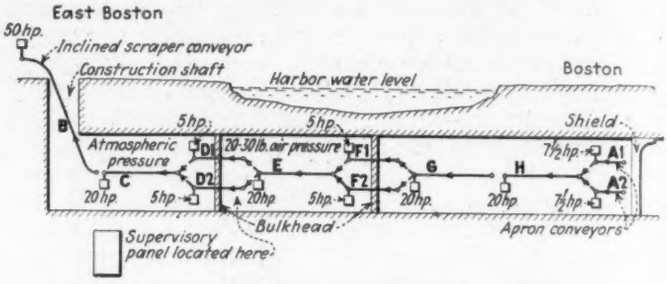
From the substation two three-phase, three-wire, 230-volt power feeders are taken into the tunnel. A booster transformer will be located at about 2,000 ft. in each feeder, with taps on the transformer to take care of increased voltage drop in the cables as the load on the power feeder increases.

Cast-iron distribution boxes similar to those used in the lighting feeders are used in the power lines wherever necessary for motor loads. Similar to the lighting feed, there are two parallel feeders to the shield to supply power to the slicer motors located within the shield. Three-phase, 200-amp. plugs and receptacles are used, and since the lines are in parallel, either feed can be disconnected to prevent interference with the erector arm. To make the plug watertight a wedge-shaped rubber bushing clamps down on the cable.

The motors for the two "apron conveyors" used are located about 40 ft. back of the shield. Two "Tirex" cables supply power to the apron conveyors and clay slicer motors. These cables are in parallel and are connected to a three-pole, double-throw switch so that power can be supplied from either main power feeder.

The various conveyor motors are controlled by three-pole magnetic contactors mounted on slate panels in watertight, gasketed steel cabinets. A strip heater in each cabinet prevents condensation. The motors are protected by two magnetic inverse-time limit overload relays instead of thermal overload relays because of the temperature difference between the motor and the control within the heated cabinet. By a double-throw switch in the control cabinet a conveyor motor may be thrown on either power feeder. Fuses of heavy capacity are provided for each motor to serve as a back-up to the overload relays in case of short circuit. The fuses are rated from two to three times the rating of the magnetic overload relays so that they will not blow except under the most severe conditions. Fuses for the motor circuits are located in the distribution boxes.

For the first time in the history of tunnel digging a complete conveyor system is used for handling the "muck" from the shield in the tunnel to the truck on the street. A schematic arrangement of the conveyor system is shown below. The two conveyors marked



Schematic diagram of conveyor system

All motor controls are interlocked to prevent piling up of material in case of stoppage of flow beyond the normally operating equipment.

A1 and *A2* are known as the "apron conveyors" and are fastened to the shield. As the tunnel progresses, sections are added to the conveyor into which these apron conveyors feed until the total length of a conveyor is about 1,200 ft. The sketch shows the conveyor system as the tunnel nears completion. Near the beginning of the job the system may consist of only conveyors *B*, *C* and *A1* and *A2*. A little later the system will consist of conveyors *B*, *C*, *D1*, *D2*, *E* and *A1–A2*.

The motors of each conveyor are interlocked with the preceding motor, so that if one conveyor is stopped all the conveyors feeding into this conveyor automatically stop and thus prevent the piling up of muck. This interlock is accomplished by wiring the control circuit of a motor through a "normally open" auxiliary switch mounted on the contactor of the preceding motor. By means of a double-throw switch mounted in the control cabinet of the motor this interlock can be cut out so that a conveyor can be operated locally for testing without running the entire conveyor system.

Just inside of the first air lock there is a supervisory panel, with a red and green light on it for each conveyor motor. If a motor is interlocked with the other motors, i.e., for automatic operation, a green light shows on this panel. The red light on the supervisory panel comes on when a motor is stopped by one of its own push buttons. Thus the operator at the supervisory panel by telephone can notify the "shift boss" or the electrical and mechanical repair squads regarding trouble location.

All push buttons for the conveyors are of the maintaining contact type, so that in case of trouble the conveyor is locked out and must be started at the push-button station where the motor was stopped. The operator can stop the entire conveyor system by pushing the "stop" button for conveyor *B*.

Successful operation of the conveyor system depends upon operation through the air lock; that is, conveyors *D1–D2 or F1–F2*. Each of these conveyors is about 30 ft. long and is placed in a boiler-plate drum about 5 ft. in diameter, with a gate at each end for loading and unloading. This drum is arranged so that it can be compressed to the air pressure in the tunnel for loading and then decompressed to atmospheric pressure for unloading. In general, the operation consists of alternate loading and unloading of a conveyor.

The motors for driving these conveyors are two-speed, double winding (900/600 r.p.m.) so that the conveyor is loaded at slow speed and then discharged at high speed. In this way a conveyor completes its unloading and is ready to receive the muck by the time the other conveyor is through loading. The interlock on these motors for the next motor is taken care of by a slow drop-out relay to prevent the next motor from stopping when the motors changed speed.

By means of limit switches and interlocks, both electrical and mechanical, the operations are tied together so that failure to complete any one operation will cause the conveyor to stop and an alarm to be sounded. Lights on a special signal panel flash on and indicate the operation as the conveyor passes through the various steps of its cycle.

▼ ▼ ▽

Electric Welding Saves Steel on Hospital Job

By J. L. FADEN

Edison Electric Illuminating Company of Boston

Twenty-nine additional tons of steel would have been required had shop riveting and turn-bolt construction been used in the field in erecting the new pediatric building of the Boston City Hospital instead of electric welding. The electrical method was used principally on account of its economy and quietness over other practice. Both shop and field connections were thus welded. The new building is in the form of a Roman cross with the main portion 143x43 ft. and wings 28x12 ft., the height being ten stories. The total frame contains 492 tons of steel. The cost of steel supplied and erected was $34,750, of which $3,495 represented the cost of field welding including labor. The cost of shop welding was not recorded. The estimated additional cost of steel without electric welding was $1,250. Mellon, Taylor & Hendrickson, Inc., Philadelphia, were the welding contractors.

Welding Data

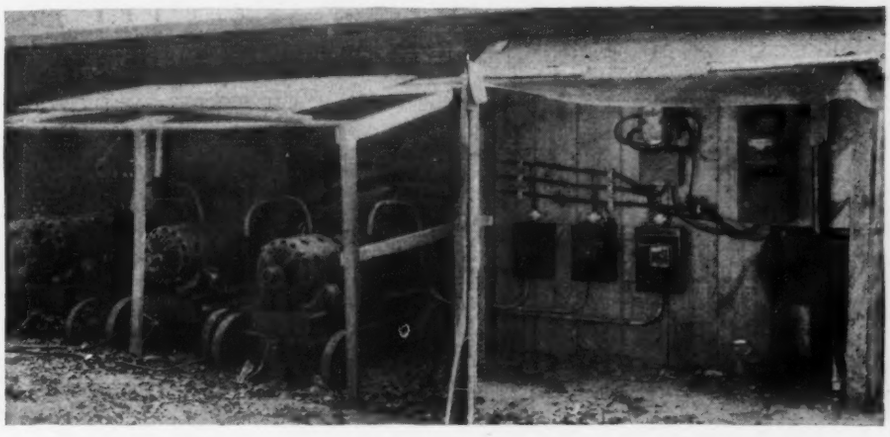
Pediatric Building, Boston City Hospital

Shop Welding	
Total steel, tons	492
Total fillets (all sizes), inches	37,138
Equivalent ⅜-in. fillet, inches	45,627
Fillet (all sizes) per ton of steel, inches	75.5
Equivalent ⅜-in. fillet, per ton of steel, inches	92.7
Field Welding	
Total steel, tons	492
Total fillets, all sizes, inches	25,686
Total equivalent ⅜ fillet, inches	29,265
Fillet, all sizes, made with gasoline-driven machine,* inches	177
Fillet, all sizes, made with motor-driven machine, inches	25,509
Equivalent ⅜ fillet made with gasoline-driven machine, inches	229
Equivalent ⅜ fillet made with motor-driven machine, inches	29,136
Total welding hours	557
Fillet, all sizes, per welding hour, inches	46.1
Equivalent ⅜-in. fillet per welding hour, inches	52.7
Fillet, all sizes, per ton of steel, inches	52.2
Equivalent ⅜-in. fillet per ton of steel, inches	59.7
Electrode used and wasted, lb.	1,120
Electrode melted (assume 80 per cent), lb.	896
Electrode melted by motor-driven machine, lb.	890
Energy used in welding, kilowatt-hour	3,980
Fillet (all sizes) per kilowatt-hour, inches	6.4
Equivalent ⅜ fillet per kilowatt-hour, inches	7.3
Electrode melted per kilowatt-hour, lb.	0.22
Fillet (all sizes) per pound of electrode used and wasted, inches	22.9
Equivalent ⅜ fillet per pound of electrode used and wasted, inches	26.2
Fillet (all sizes) per man day of eight hours, feet	30.7
Equivalent ⅜-in. fillet per man day of eight hours, feet	35.1

*Gasoline-driven welding set used at start of job until electric motor sets were put in operation

Typical arc-welded joint between 14-in. column and 21-in. girder

Rigid conduit safeguarded service to welding motor-generators from switch and meter installation in hospital yard shelter



Plant Distribution on a Watt-Per-Square-Foot Basis

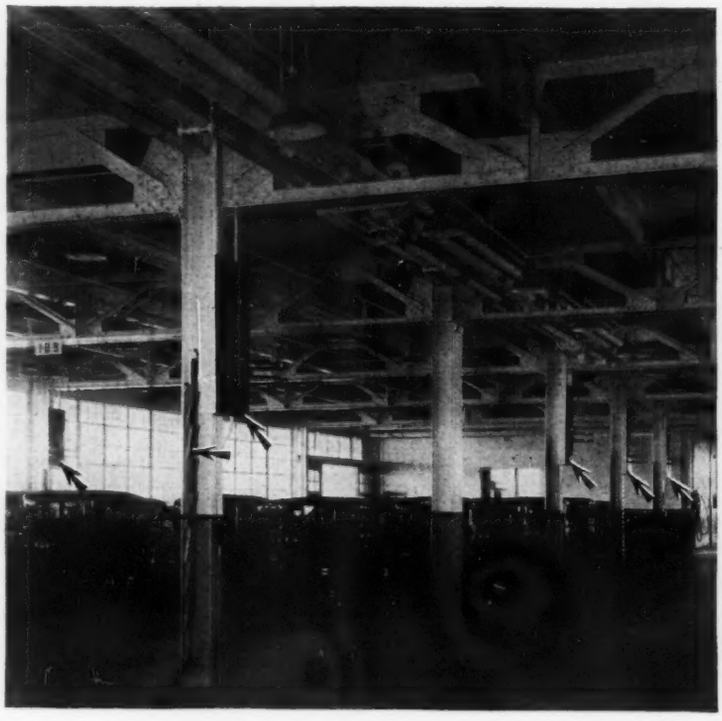
At the Richmond, Calif., plant of the Ford Motor Company both power and lighting distribution circuits have been laid out on a watt-per-square-foot basis. Disregarding the initial requirement of the various factory areas, sufficient capacity is provided in power and lighting circuits to supply the entire factory area with the amount of energy and light sufficient to take care of rearrangement of processes which future manufacturing activity may dictate.

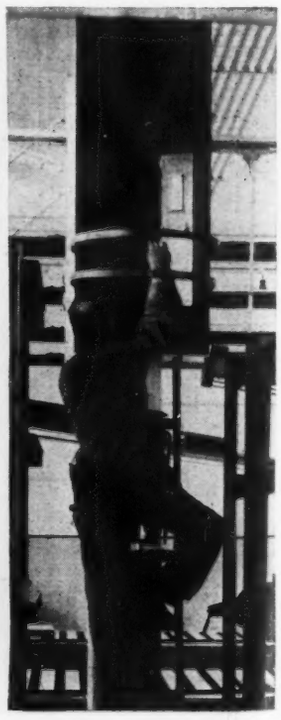
One of the unusual features of the electrical installation at this plant is the location of the power and lighting distribution panels. These are mounted approximately 8 ft. above the level of the floor at regular intervals throughout the factory. Panels are of dead-front type and are made accessible by means of a collapsible ladder which is furnished at each panel location. These ladders, padlocked into the supporting column of the panels, are accessible only to the electricians of the plant, who are provided with keys for the ladder lock, so no unauthorized person can tamper with panelboard circuits.

Ladders are provided with permanent, U-shaped metal keys which fit into slots on the face of the panel and which cannot become accidentally detached while a man is working on the ladder. As an additional safety factor, each panel is provided with two steel hoops encircling the space in front of the panel so that it is impossible to fall backward off the ladder when working on the board.

Advantages of this class of construction include better utilization of floor space, safety, easy accessibility to overhead conduit circuits and the elimination of trouble through tampering with the panelboard by unauthorized persons. The permit was the first of its kind to be issued by the California Industrial Accident Commission for this class of construction and was authorized only after such safety features as the padlock, collapsible ladder and projecting band around the panels were demonstrated to meet all safety requirements satisfactorily.

This new plant of the Ford Motor Company represents decided advances in the technique in supplying adequate electrical facilities to manufacturing establishments. Adequacy seldom found in even the most modern plants, has been incorporated in the original design as evidenced by the fact that the electrical distribution system includes more than 60 power distribution panels spaced at practically equidistant intervals throughout the factory and approximately 50 lighting distribution panels serving a 999-kw. lighting load. The lighting load is composed of approximately 2,700 units mounted at a 20-ft. height on 10- to 14-ft. centers throughout the plant, more than 400 mercury-vapor units, each rated at 450 watts, and 66 "Holophane" units mounted in the receiving bay. Costs of lighting are estimated to be 2 per cent of the factory payroll itself, an indication that adequate electrical facilities are an indispensable adjunct of modern production.





Lighting and power panels made accessible by collapsible ladder padlocked to column when not in use

▼

READERS' FORUM

Who Said It First?

To the Editor of the ELECTRICAL WORLD:

"An arc lamp is as good as two policemen."

This expression appeared in an editorial on page 658 of the ELECTRICAL WORLD, September 26, 1908. With some variations it has been quoted many times in the press and has been attributed to various public officials. In the *I.E.S. Transactions* of October, 1907 (Vol. II, No. 7, page 634), W. H. Blood, Jr., quoted a similar statement as having been given in a recent public address by a Police Commissioner of New York.

As a matter of interest and historic accuracy, I wonder if one of your readers could cite an earlier use of the expression and give the name of the author.

Nela Park, Cleveland. G. H. STICKNEY.

Men of the Industry

James Simpson New Chairman of Insull Utilities

James Simpson, who was appointed chairman of the board of directors of the Commonwealth Edison Company, the Public Service Company of Northern Illinois and the People's Gas Light &

Coke Company, as announced in the June 11 issue of the ELECTRICAL WORLD, has been chairman of the Board of Marshall Field & Company since 1930. Although Mr. Simpson is known chiefly as a merchant, for many years he has devoted some attention to activities outside the merchandising field.

A native of Glasgow, Scotland, Mr. Simpson removed to the United States in 1880 when he was six years of age. Settling in Chicago, he attended the public schools and a business college. He began his career with Marshall Field & Company as a clerk in the cashier's office and one year later was chosen by Mr. Field to work in his office. It was not long before he was made Mr. Field's confidential secretary. When Mr. Field died in 1906 Mr. Simpson was elected second vice-president. He become vice-president in 1917, and upon the retirement of the late John G. Shedd in 1923 he became president of the company. Early in 1930 he was elected chairman of the board. Since 1917 he has been a director of the Federal Reserve Bank of Chicago as well as deputy chairman. In addition he has been one of Chicago's most prominent civic workers.

▼

H. C. FORBES, research engineer, electrical engineering department of the New York Edison Company, has been appointed system engineer. Mr. Forbes joined the New York company in 1924 as assistant to the chief electrical engineer, later continuing in the electrical engineering department as assistant research engineer. He was made research engineer in 1927. He is a graduate of the University of New Hampshire and the Massachusetts Institute of Technology, where he also served for two years as an instructor. Before joining the New York utility he spent one year in the apparatus development department of the Western Electric Company. He has served as a member of the American Institute of Electrical Engineers committee on power transmission and distribution, the committee on high-tension cable of the Association of Edison Illuminating Companies and the overhead systems committee of the National Electric Light Association.

•

FRED S. BURROUGHS, a director of the Associated Gas & Electric Company, has been elected a vice-president of that company. Mr. Burroughs recently resigned as executive vice-president of the Chase Harris Forbes Corporation. He will remain as president of the Public Utility Holding Corporation of America, organized three years ago by the Harris Forbes Corporation and other interests.

▼

J. E. E. Royer Vice-President of Spokane Utility

J. E. E. Royer, general manager of the Washington Water Power Company, was elected a vice-president of the

company at a recent meeting of the trustees, according to the announcement of Frank T. Post, president. Mr. Royer will continue as general manager.

Mr. Royer entered the employ of the company in October, 1907, following his graduation from college. His first work was with construction crews in connection with the maintenance of power stations and substations. He was next assigned to the light and power department and in 1919 was made assistant superintendent of that department. In November, 1924, he was appointed assistant general manager, and he became general manager in 1930.

▼

OBITUARY

C. F. Smith

Charles F. Smith, a vice-president of the Central Ohio Light & Power Company, Findlay, died June 5 at his home in that city, following a six months' illness. For more than forty years Mr. Smith had been prominent in the electric light and power and electric railway industries and during that period had been active in the various regional and national organizations. He was born in Cincinnati in 1863 and spent a decade with utility interests in his native city before transferring his interests to Findlay in 1887. He first electrified the street car lines in Findlay and gradually extended and interconnected the lines with outside cities. For 42 years he had been general manager of the Toledo, Bowling Green & Southern Traction Company and its predecessors when he retired from active service in 1929. In 1892 he helped to organize the Hancock Light & Power Company and became its president. In 1904 the present steam power plant was constructed.

•

GEORGE BULLOCK, president of the International Burners Corporation, New York, and chairman of the board of the Erie (Pa.) Railways Company, died May 30 at his home at Oyster Bay, N. Y. Mr. Bullock was the organizer of the Bullock Electric Manufacturing Company some years ago and in a short time built up one of the largest industries in Cincinnati, manufacturing electrical machinery of all kinds. The company was leased to the Allis-Chalmers Company and later Mr. Bullock sold his controlling interest to the Allis-Chalmers Company and retired from the presidency. His experience embraced not only the manufacture of electrical machinery but also the operation of electric light, railway and gas properties. Starting with a technical education received at Cornell University, he became electrical engineer for the street railway lines running from Cincinnati to Covington and Newport, Ky. Subsequently he took charge of these lines and under his management all the lines were electrically equipped. Later he was appointed vice-president and eventually president. He took a directorship in the Cincinnati Street Railway lines and was elected president of the Cincinnati Edison Company. It was in 1906 that he assumed the management of the United Gas & Electric Company as its president, with headquarters in New York.

New Equipment Available

Hollow-Electrode Furnace Reduces Ores to Steel

By passing finely divided ores intimately mixed with reducing materials through the hollow electrodes of an electric furnace high-grade plain-carbon and alloy steels may be produced. Such a furnace, discussed as a notable advance in steel making at the recent Electrochemical Society meeting, is offered by the Buffalo Electric Furnace Corporation, Buffalo, N. Y. This type of furnace accomplishes in a single unit the production of a refined and finished product from metalliferous ore. It is said to have an output comparable to even the highest-grade electric furnace, even though acting in melting, refining and alloying capacities simultaneously with its equivalent blast-furnace function.

In this Wiles hollow-electrode furnace there are two hollow-side electrodes in a horizontal position. These electrodes serve as a carbonaceous retort or chemical reaction chamber, and so accurate is the control of the melt and of the temperatures that hitherto impossible metallurgical work is said to be wholly feasible.

▼

Electrode Holder Stand Saves Power

A new electrode holder stand which automatically shuts down the welder one minute after the holder is placed on the stand and instantly starts it when holder is removed is announced by the Lincoln Electric Company of Cleveland. It is claimed that the automatic start-and-stop feature of the new stand effects a decided saving in power consumption. Heretofore it has been common practice to let the welder run continuously during working hours even though the operator may actually be welding intermittently throughout the day.

The stand is of arc-welded steel construction throughout. The holder hook can be raised or lowered on the upright member to suit the convenience of the operator. Fifteen feet of rubber-covered, two-conductor cable is provided with the stand for connection to welder. The "Power Saver" can be used whenever the welding equipment is provided with an automatic motor starter having two-wire pilot control.

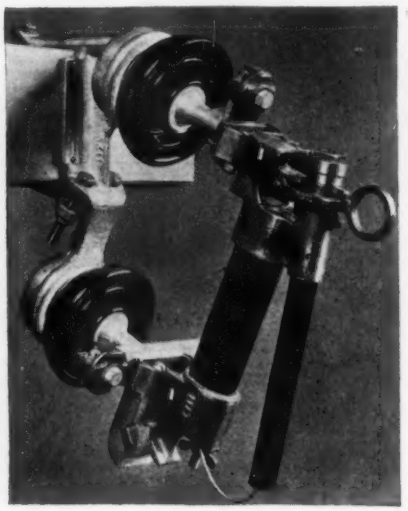
▼

A BURNER MADE FOR A GAS PRESSURE of 2 to 8 oz., known as the type BL Forney gas burner, has been placed on the market by the Forney Combustion Engineering Company, Dallas, Tex. The head, which is made of heat-resisting alloy, thereby eliminating the possibility of damage by the furnace heat, can be supplied in a large number of orifice sizes to give the particular rating desired with the gas pressure available. Six different sizes, varying in capacity from 2.5 to 300 boiler horsepower, are made.

▼

Fuse-Disconnecting Switch Designed for Rural Service

A type of fuse-disconnecting switch specially designed for rural service, but following closely the larger-capacity equipment in successful use in transmission for a number of years, is offered by the Hi-Voltage Equipment Company, Cleveland, Ohio. The fuse tube is supported at its closed end so as to provide an air gap between the open end of the tube and the outside fuse link terminal after the fuse has blown. This air gap, which is introduced in the circuit with the blowing of the fuse, together with other features characteristic of "Hi-Voltage" construction, makes the fuse positive in operating on light as well as heavy loads. The air gap prevents any leakage of current through or over the fuse tube. The entire voltage stress is across the porcelain insulating blade.



Insulators are of the cap-and-pin type. The contacts were developed primarily from a mechanical standpoint and are said to assure conductivity far in excess of operating requirements. A positive lock prevents accidental opening of the fuse. Electrical porcelain is used throughout. The fuse is laminated bakelite, which is unaffected by atmospheric conditions. A substantial swivel bracket adjustable 30 deg. either side of the central position is used on the vertically mounted 7.5-kv. and 13.2-kv. fuses.

▼

High Strength, Low Weight in Built-up Welded Floors

A new steel floor slab, fabricated by pre-forming two steel sheets and subsequently welding them together in the plane above the neutral axis, known as the Robertson Keystone-beam steel floor, is announced by the Mellon Institute of Industrial Research. A cross-section taken through the width of a completed unit shows four keystone-shaped cells, all connected together near the neutral axis. This design is said to provide maximum load-carrying efficiency of the metal. It is reported that the high strength factors, combined with the relatively low weight per square foot, make possible savings in building construction because of the decreased load-carrying requirements for floor slabs, columns and foundations. The four ducts that constitute each unit are spaced at 6-in. intervals and connect directly when installed with the corresponding ducts of the adjacent section of floor slab.

▼

A NEW LIGHT-WEIGHT UNIVERSAL STRAIN CLAMP designed for use in stringing distribution lines, substation buses, low-current transmission lines and overhead ground wires is announced by the Ohio Brass Company, Mansfield, Ohio. Although light of weight, this clamp will develop an ultimate of at least 10,000 lb. High slip strength is provided by the V-shaped seat and by the curvature of the clamp body. All conductors for which the clamp is designed are held securely in its grip.

•

A NEW TYPE SDS-2 GOVERNOR which controls within close limits any excess pressure from 15 to 150 lb. is announced by the Northern Equipment Company, Erie, Pa. It can be installed on simplex or duplex pumps and on turbine or motor-driven centrifugal pumps and for constant-pressure service up to 150 lb.

•

A NEW SPOTLIGHT which, besides furnishing either white or colored light, produces four distinct types of light control is announced by Curtis Lighting, Inc., Chicago. The barrel is $5\frac{7}{8}$ in. in diameter, 15 in. long and has a $4\frac{1}{2}$-in. lens. A sliding socket wired with 6 ft. of No. 14 asbestos-covered stranded wire and separable plug is moved forward or back in the unit to change the spread of light. The spotlight is locked at the correct angle by turn screws on the trunnion yoke.